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ABSTRACT

This handbook describes a model for providing professional development time for teachers by matching them up with volunteers from local industries who regularly replace them in the classroom. This industry volunteer model offers a way for business and industry to support professional development for local classroom teachers by contributing a resource difficult to obtain--released time. It allows teachers to meet together during school hours without hiring costly substitute teachers, and it mines the expertise of local community volunteers whose work experience is relevant to the teachers' subject matter. The first eight sections of the handbook discuss the issues of organizing and arranging a project using the industry volunteer model. Topics covered include: how an industry volunteer model works, deciding to use an industry volunteer model, recruiting corporate partners, recruiting industry volunteers, training industry volunteers, expected contributions from program participants, keeping things running smoothly, and evaluating program results. The final section contains sample materials from other industry volunteer projects that have used the model. (KC)

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Industry Volunteers in the Classroom

Freeing Teachers' Time for Professional Development

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Industry Volunteers in the Classroom

Freeing Teachers' Time for Professional Development

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by the
National Science Foundation
Opinions expressed are those of the authors
and not necessarily those of the Foundation

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Acknowledgments

I would like to thank the many people who have been involved in the creation of this handbook. When we first developed the idea of industry volunteers replacing teachers in the classroom to free them for staff development, we were aware that our proposal would be challenging for industry, for teachers, and for students. As the process developed and eventually culminated in a proposal to the National Science Foundation, we relied on many people who not only gave us counsel, but also were willing to take a risk with a novel idea.

I would like to thank the following people from our local industries: Palmer Swanson and Charlie Lawrence from the Polaroid Corporation, Barbara Sarkisian-Arthur from Digital Equipment Corporation, Karen James-Sykes and Jill Johnson from NYNEX, and Walter Carleton from GTE Laboratories. These people were instrumental in securing corporate commitment to participate in both our Middle School Math and our Teachers, Time and Transformations projects, and in providing guidance during our training phase.

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Some of our teacher and industry participants have experienced the industry volunteer model in their classrooms for more than three years now. We have relied upon their wise feedback during this time, and we have greatly benefited from their good and gentle advice. We are especially grateful to John Meschter, the Polaroid Corporation; Gary Muello, NYNEX; Carol Martignette, Arlington High School; Joanne Crowe and Dolores Weir, Kennedy Middle School; Mary Lou Mehrling, King Open

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Special recognition goes to Grace Kelemanik, associate project director, for overseeing the entire project and for providing insight, sensitivity, guidance, and wisdom throughout the project. Grace's humanism and talent in working with people from different worlds are clearly evident in this production.

And we are extremely grateful to our many colleagues at Education Development Center who provided encouragement and enthusiastic input along the way: Myles Gordon, vice -president, who wholeheartedly provided support and guidance in the initial development concept; Al Cuoco, Marianne Thompson, and Sue Rasala, who led an outstanding staff development experience for our teachers; and Angela Daskalos, Albertha Walley, Marty Earley, Chris Brown, Caltor McLean, Tom Rielly, and Sophie Broderick who furnished administrative support. Dr. Jerome Schultz was instrumental as well in the design and implementation of the industry training model.

I would like to thank the production team for the careful translation of the industry model into written word. The creation of this handbook would not have been possible without the diligent efforts of coordinator Natasha Sabath. Our writer, Jennie Dautermann, should be credited for her thoughtful and coherent synthesis of a broad range of materials and ideas. Our thanks to the creative talents of designer and layout person, Sandy Belk.

In creating this model, one experience stands out as shaping my thinking in involving industry in the classroom. My work in Project Bridge at the Polaroid Corporation put me in contact with an extraordinary mentor, Tony Cardello. Tony was convinced, in the creation of Project Bridge, that we needed to "bridge" the worlds of industry and education in as many ways as possible. This project is clearly an extension of the work begun by Tony and many others at Polaroid.

And last, my thanks to those people not mentioned here — of whom there are many — who firmly believed that "we're all in this together."

Faye Ruopp
Project Director

digital

DIGITAL EQUIPMENT CORPORATION

Robert B. Palmer
President and Chief Executive Officer

Maynard, Massachusetts
01754-2571

Digital Equipment Corporation is proud of its ongoing support of the Education Development Center (EDC), as it helps enhance teacher development and prepare students to improve their math skills for future careers in technology and the sciences.

We have joined other corporations, including Polaroid and New England Telephone/NYNEX, in encouraging employees to serve as volunteer teachers in EDC-based programs. By bringing industry into the classroom, students not only learn from those who use math as part their day-to-day-work, but teachers also are exposed to the practical application of math in the workplace through their collaboration with employee volunteers.

Digital employees have been enthusiastic and committed to their work in the classroom. They have found it personally rewarding and recognize it as a way that they can contribute to the quality of education in local school systems.

EDC has created this handbook as a means of sharing its program experiences with others across the country. Digital's involvement with EDC has been very successful, and we hope that through this publication, other teachers, school systems and corporations may learn and benefit from similar public/private educational initiatives.

RBPalmer

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Polaroid

DISSEMINATING THE MODEL

The Polaroid Corporation has been an active participant in EDC's model which uses industry substitutes in schools in order to free teachers' time for staff development.

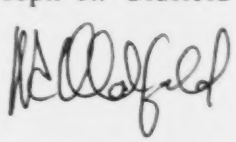
The production of this handbook is an important first step in "getting the word out" that such a model not only works, but works very effectively.

A number of initiatives at Polaroid are focussed on the long-term improvement of math and science teaching in our nation's schools. From the start of these initiatives, it has been our intention to share our learning and experience with other interested companies, large and small, trusting that similar models will proliferate.

Not only do schools and students benefit; employees who have participated in the EDC project as classroom teachers in Greater Boston-area schools come back to the industrial workplace enriched by their experience. Many cite their improved presentation skills as a decided workplace plus. Further, they return with a greater appreciation and understanding of the conditions and realities of schools and teaching.

We're delighted to have had the opportunity to partner with EDC in its continued effort to improve mathematics education on a national level. With the publication of this handbook, we wish you continued success.

Cordially,
Joseph R. Oldfield



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Introduction

In a time of profound reform in curriculum, instruction, and assessment in the nation's schools, the preparation of teachers to participate in and assume leadership of these reforms is essential for their success. Teachers' professional development is an increasingly important component of educational change and improvement. Studies have shown that effective teacher development programs often share the following characteristics:

- They occur during the teachers' regular workday.
- They bring a consistent group of teachers together over time.
- They give teachers access to current expertise in their subject area.
- They offer teachers sufficient time to reflect on challenging ideas.
- They encourage teachers to adapt innovations to their own teaching.
- They provide opportunities for collaboration with other teachers.

Because of increasing demands on schools and a climate of strenuous budget reductions, most school districts are finding it increasingly difficult to fund teacher development programs. Under these pressures, some districts have reduced their in-service staff development programs. Others require teachers to participate in staff development activities on their own time, adding more burdens to the teachers' after-school hours, already crowded with support of student social activities, sports, and class preparation.

This handbook describes a model for providing professional development time for teachers by matching them up with volunteers from local industries who regularly replace them in the classroom. This industry volunteer model offers a way for business and industry to support professional development for local classroom teachers by contributing a resource perhaps more dear than grants or equipment — released time. It allows teachers to meet together during school hours without hiring costly

"The luxury of arriving at EDC on Thursday mornings fresh and ready to learn is a gift I treasure. Most people don't realize that teachers almost never get to talk to one another about their work, to learn from one another, to be professionals together. Because of you and this project, I now have colleagues I'm not afraid to ask for help, colleagues who will cheer me on to try new things even when I fail."

A classroom teacher

substitute teachers, and it mines the expertise of local community volunteers whose work experience is relevant to the teachers' subject matter.

In one recent project sponsored by Education Development Center (EDC), industry volunteers enabled mathematics teachers to attend a comprehensive, year-long seminar series where consistent attention to professional growth, risk-taking, and reflection were made possible. Like their students, teachers need time to engage in new ideas and approaches, reflect on their own learning, systematically examine their practices, and explore applications of what they are learning (Schön, 1983; see margin). Industry volunteer teams make that possible.

This handbook is a guide for those who wish to use such a model in their own local contexts for a variety of purposes. Accordingly, this handbook focuses on the industry volunteer model without extensive reference to the nature of the teachers' activities that operate in parallel with it. We offer the model as a means of providing teacher time so that dedicated educators and others can use that time for a range of teacher projects.

"I thought teaching algebra would be hard. The algebra part was easy; it was the teaching that was hard. It is all a lot harder than I anticipated. I have great admiration for the teaching profession."

An industry volunteer

For further reading on teacher development, see these sources:

D. A. Schön, The Reflective Practitioner *(New York: Basic Books, 1983)*

B. Joyce and B. Showers, Student Achievement Through Staff Development *(New York: Longman, 1988)*

How to Use This Book

The first eight sections of this handbook discuss the issues of organizing and arranging a project using the industry volunteer model. We discuss initiating a project, recruiting corporate partners, training the volunteers, and supporting them in the classroom.

The Sourcebook (Section 9) is separated from the other sections by a special tab. It contains sample materials from EDC projects that have used the model. You may reproduce or adapt any of the resources included in the Sourcebook for use in projects of your own.

1

How Does an Industry Volunteer Model Work?

EDC has for several years been recruiting corporate sponsors in the Boston area to release teachers to participate in professional development projects. In the EDC model, classroom teachers leave their students for specific professional development activities while industry volunteers replace them on a regular basis throughout the year. Because industry volunteers have been most effective and comfortable when assigned to classrooms in pairs, such a project needs twice the number of volunteers as the number of classroom teachers involved. Nevertheless, in the past four years, EDC projects have provided 7,264 hours of professional development time for 76 mathematics teachers in elementary, middle, and high schools.

Industry volunteers are encouraged to look for ways of making specific connections between their work and the classroom material and to design original lessons that build on those connections. They sometimes teach material specified by the classroom teacher as well.

An industry volunteer model sets up a global partnership among local industries, schools, and educational support groups (see Figure 1.1) as well as a classroom partnership among the two industry volunteers and a classroom teacher.

While this model specifically purchases free time for teachers to engage in professional development activities, it also offers significant benefits to the other participants.

"To try to attach a monetary value to the contributions made by our employees would be impossible. Our company's belief that employees are our strongest asset is exemplified by our involvement with this program."

A corporate liaison

The Corporate Partners

Our corporate partners concerned about the education of their future employees and their own children are often quite interested in ways to support their local schools. An industry volunteer model offers a way for such interest to be expressed in a concrete, mutually helpful way.

Most corporate partners recognize the value of the teaching and communication skills their employees gain from volunteering in our programs. This venture also responds to the pressing reality of downsizing

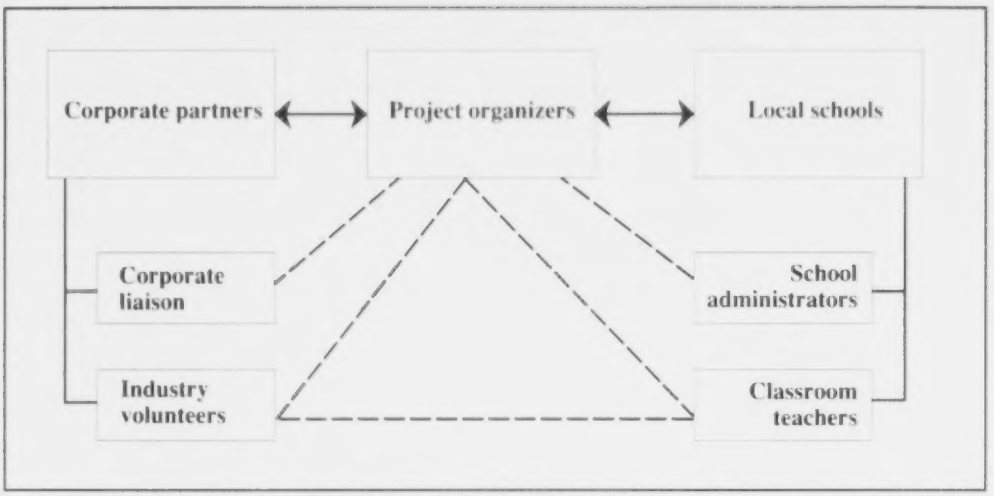

Figure 1.1 Global Partnerships for an Industry Volunteer Model

for some companies, by providing tangible support for potential employee transitions into teaching.

We ask corporate partners for released time for the volunteers, for management support, and for some sort of corporate recognition for the volunteers. We also request that a corporate liaison be appointed to serve as a primary contact for the project organizers within each company. This liaison also helps with volunteer recruiting.

"The thing that stands out most is that I knew whatever [the industry volunteer] taught me she was really using in real life. This helped me become much more interested in learning."

A student

The Participating Schools

The experience industry volunteers share with students can lead to improved education and a better work force in the 21st century. When industry volunteers talk to students about their work, bring in demonstrations, or base lessons on their work experience, they make a significant impression on the students. While teachers can and do relate the importance of their subject knowledge to the work world, having industry volunteers bring their work into the classroom lends new meaning to the schoolwork.

Industry volunteers in classrooms not only offer students tangible evidence of the relevance of school subjects to the world of work but can provide role models of women and people of color in successful careers. They also give students evidence that there are other interested adults who care about their progress.

Some of our volunteers have made noteworthy contributions to schools where they worked. They have taken students on field trips to their companies; they have arranged for donations of equipment and other resources; and some have established special relationships with individual students they have encountered through the program.

Participating schools benefit from renewed, professionally stimulated teachers whose enthusiasm affects both their classes and their colleagues. Schools also benefit from the volunteers' increased awareness of the prob-

lems facing schools and their appreciation for the complexity of teaching. Such increased sensitivity helps make these volunteers informed, vocal advocates for education in their communities and workplaces.

The Industry Volunteers

Since the volunteers are the key to the model's success, much of this handbook is devoted to issues related to their selection and training. We have found that most volunteers are surprised by the energy levels a classroom requires, but they frequently bring a vigor and creativity to the classes that is contagious.

The industry volunteer model provides a form of "reverse internship" for workers who return to the classroom, often for the first time since they were students themselves. Spending time in schools gives industry volunteers a valuable perspective on the needs, demands, and rewards of teaching and learning in today's schools. Volunteers tell us about their enhanced awareness of the needs of education, the scarcity of resources in many schools, and the complexities of a teacher's work. Some volunteers have used this experience to look closely at the possibility of making a career change, and a few have actually done so. Others tell us they appreciate the opportunity to "give back" to the communities where they themselves grew up and were educated. They all receive the intangible rewards of working with young people, along with a sense of adventure about what they have accomplished.

> *"Teaching is a complex profession made more difficult by the educational infrastructure, the budgetary constraints, and the social problems that impact students and their families. The demands of the job are not obvious to the public. My admiration and respect grow daily for those who make a career out of teaching."*
>
> *An industry volunteer*

The Classroom Teachers

The relationship between the industry volunteers and their classroom teacher can substantially enhance the teacher's view of their common subject matter. Teachers in all the EDC industry volunteer projects report a new sense of interest in their own work and positive responses from their students to this way of connecting academic subjects to workplace applications. In some instances, the teachers and volunteers have collaborated to create new lessons or teaching units for the teacher to use well after the project has been completed. (See "City Planning Math Project," in section D-5 of the Source Book.) In any case, industry volunteer teams provide an important professional resource for the classroom teacher. Ultimately, the industry volunteer model provides the classroom teacher with time to engage in meaningful professional development. The learning that takes place during these development experiences is the true benefit to the classroom teacher.

> *"The Polaroid employees taught the students about film and cameras; the Digital Equipment employees taught about computers and robotics; and the NYNEX employees taught about telephones and networking."*
>
> *A project evaluator*

The Project Organizers

Any industry volunteer model must have some designated organizational support. The EDC projects have been designed to incorporate education consultants who supervise the industry volunteer model, the

teacher programs, and the evaluation of the entire endeavor. It seems possible that any of the partners could initiate and supervise the industry volunteer activities; nevertheless, specific project organizers would be needed to keep things running smoothly. This handbook outlines the responsibilities of such project organizers.

"I respect teachers much more. It takes a unique individual to maintain the positive attitude and patience to teach. I now understand the concept of teacher burnout!"

An industry volunteer

2

Deciding to Use an Industry Volunteer Model

Although EDC programs are the source of specific examples throughout this handbook, we do not intend to imply that the model can be applied only in the ways we have used it. It is our hope that a variety of sponsorship patterns will emerge to meet the needs of teachers in a number of disciplinary contexts.

We can foresee staff development personnel in school districts using this technique to support projects they could not otherwise afford. We can also imagine use of the device by industry-sponsored projects that engage local educators or parent groups in efforts to improve their local schools.

We can envision groups of teachers using this model to secure support for collaborative work in general, subject-matter collaboratives, curriculum development, and other activities. Teacher-led initiatives are often the most vigorous and successful mediators of professional development in the field; certainly, they are most sensitive to the specific needs of those teachers involved.

Education resource sites, such as universities and other organizations that support professional development for teachers, may also find this a useful way to extend their funding resources and establish partnerships between schools and industry. EDC's interest grew out of a need to support specific teacher development projects. EDC staff members found this industry volunteer model to be a convenient way to buy teachers time for their professional development projects.

"[The EDC project organizer] recruited the companies and the volunteers, designed an orientation for the volunteers, smoothed ruffled feathers and bruised egos when the going got tough, found alternates when volunteers were transferred or dropped out, and counseled teachers on working well with their partners. Her attention to detail and individuals made a risky endeavor into a program to be emulated."

A program evaluator

Setting Goals

Some project organizers adopting this model may intend to seek outside support from funding organizations; in such cases, writing a proposal helps to refine project goals and clarify thinking. Yet, organizers of projects without formal grant sponsorship also need to negotiate their expectations and purposes with the corporate partners, the schools, and

In some states, substitutes must hold teaching certificates. Contact your local school district office to see if this is necessary.

the educational support groups (local universities or organizations like EDC).

The goals of these global partners can be compatible, but they are not identical. Business and industry representatives may be interested in the reverse internship features referred to in Chapter 1 or in increased volunteerism among their workers. School district officials may be seeking ways to stretch their shrinking staff development dollars without sacrificing genuine teacher growth. Organizers of teacher cooperatives are usually concerned with balancing the quality of the experience they will get in exchange for the doubtful prospect of giving their classes over to relative strangers.

Whatever the nature of your own teacher project, its design should reflect the interests of all these groups while being as efficient and simple as possible. A successful project must have organizers who establish and maintain mutual understanding of the lives, values, and terminology of these diverse groups.

When the project goals are clearly stated, evaluation makes sense, decisions on day-to-day issues become more consistent, and the work involved comes closer to producing good results for students, teachers, and communities. One helpful activity in goal setting is to produce a one-page description of the program for use in informational meetings. (See item A-2 in the Sourcebook.)

Your goals must eventually reach a point at which they become specific enough to name the number of hours your teacher project will require and therefore the number of volunteer hours you will be asking for from the corporate sponsors. Details of training, program maintenance, and evaluation will need to be delegated and arranged, as will responsibility for communication links among the various groups. Our evaluators took particular notice of the key role of an organizer in projects such as this.

Assessing Resources

Once a project for teacher development is conceived, project organizers also need to assess local resources for organizations whose involvement would offer complementary expertise to the teachers' own classroom work. All industry volunteer projects need organizers who are enthusiastic individuals, able both to seek out cooperation from a variety of sources and to consistently maintain a project's ongoing progress.

Organizers of the EDC projects went to engineering and production firms seeking volunteers who could bring concrete mathematics experiences to the classrooms. Other organizers might match up writing classes to newspapers or advertising firms, science classes to manufacturing or food production companies, literature classes to publishing organizations, music classes to local performance groups, or business classes to local commercial firms or banks.

Our experience has been conducted in a densely populated area where large companies provide a rich pool of volunteers. But project organiz-

ers in small communities too may be able to find corporate partners through local chambers of commerce, service groups, or businesses committees.

Whether the sponsor of an industry volunteer model is a corporate employee, an educator, or a support group like EDC, someone must plan for the solid preparation of volunteers before they start taking over classroom responsibilities. Recruiting the corporate partners and the industry volunteers requires patient attention to detail. The recruiting tasks discussed in Chapters 3 – 4 of this handbook constitute the first stage of establishing such a cooperative arrangement. Corporate partners and volunteers are usually enthusiastic about the plan, but their participation can be complicated by the realities of the business world and their own expectations about the nature of education.

The Sourcebook (see item A-1) contains a detailed timeline that illustrates the complexities of using the industry volunteer model in support of a full academic year program for teachers. We include the timeline as a planning guide.

For further reading on one EDC project that uses the industry volunteer model, see Ada Beth Cutler and Faye Nisonoff Ruopp, "Buying Time for Teachers' Professional Development," Educational Leadership, *March 1993*

3

Recruiting Corporate Partners

This chapter discusses ways of making contacts with local companies and securing corporate commitment to support and release volunteers for the project.

Making Initial Contacts with Corporate Partners

Contacts with local companies are pure gold. You meet them every day at PTA meetings, at dinner parties, on airplanes, across the back fence — perhaps you are a company contact yourself. The first priority is to find someone who has insider status in a company interested in supporting local education projects. That insider (your very first contact) does not need to be a vice-president or a personnel director, although those people are excellent finds. Your inside contact needs only to give you one thing: NAMES. Not names of volunteers — that comes much later — but names of people in positions to commit company resources to your project. Your first contact needs only to be someone who knows someone who knows . . .

Practically all of the companies recruited for the EDC industry volunteer projects were initially met through a personal contact with someone who directed organizers to the right people in a friendly corporation. Most of the time, we got to the decision maker who had authority to commit the company only after we had negotiated our way through a group of other company officials who sent us "higher up" when we described our project.

It is important to start your recruiting efforts early. It can take as long as a year to get some companies "on board."

Securing Corporate Commitment

Many of the people who will help you cannot make the final decision for their company to become a corporate partner, so no matter where your first contact occurs, you will be expected to help convince company management that this is a good idea. You may find it necessary to

make several presentations to company officials before you secure a definite commitment from them. Such presentations require crisp definitions of the project and summary lists of what is needed in terms of hours, people, students, schools, and so on. For ways to present the idea, it's often useful to talk to the human resources office, or representatives of other volunteer programs the company supports.

Formal written proposals are not generally necessary, but good, clear statements of your program's purpose are. You need at least enough printed material so that your supporters can be effective in describing the work and its benefits to the company and the volunteers, as well as its potential for improving local education. In the Sourcebook (see item A-2) we have included a model program statement that has been used at EDC to spell out the details of our industry volunteer projects. Once you have established a track record, you may also find it helpful for a veteran volunteer to accompany you to meetings with company officials.

"Our employees, the teachers, and EDC gave the program an A+. Employees found it to be a valuable and rewarding experience, and their supervisors indicated that it did not interfere with their workload."

A corporate liaison

If you limit your efforts to a small number of companies, you may be more successful with this aspect of your project's development. Personal contacts and carefully cultivated relationships between project organizers and corporate insiders are your best recruiting tools. If you must work with a large number of companies that offer you only a few volunteers each, organizing the project will require considerably more time. In any case, up-front support for an organizer in the form of released time or funding may be necessary. It can take up to a year to get a specific company on board.

It is a good policy to ask for a letter of support from the company once it has agreed to become a corporate partner. Writing this letter helps the company spell out what it agrees to do in a way that helps everyone understand any qualifications the company stipulates for employee involvement.

4

Recruiting Industry Volunteers

Once corporate partner commitments are established, EDC staff members work with a corporate liaison to begin recruiting volunteers. We have experienced at least two patterns of recruiting activity. First, when the corporate partner operates primarily out of a central facility where everyone works, we often hold an informational meeting and interview volunteers afterward. Second, when the company is more spread out, we usually depend more on the corporate liaison to help us make contact with people in the different sites. In the latter situations, we sometimes hold several informational meetings.

Where possible, we try to set up an informational meeting for all the potential volunteers from a work site. Company personnel usually help us arrange this meeting, but EDC staff members explain the program.

Advertising such a meeting requires some attention to the most common form of company-wide communication. For some of our corporate partners, electronic bulletin boards serve this purpose, while for others, the company newsletter or a physical bulletin board is more effective. The corporate liaison is an good resource for getting this information to as many potential volunteers as possible. The clip shown in Figure 4.1 appeared in the Digital Equipment Corporation newsletter.

Because the content of the informational meeting is an early part of the training of our eventual volunteer staff, considerable thought is given to the agenda. We use some of the same materials to recruit volunteers as we use to recruit corporate partners at the organizational level. It is essential to help the volunteers see the nature of the project, the schools involved, the time commitment they are making, and our commitment to training them for the work. The Sourcebook (see item A-3) includes the agenda for an informational meeting we held recently in the Boston area. We always try to leave lots of time for questions, as these help us address the concerns people have about classrooms and being a "substitute." The Sourcebook (see item A-4) also includes a list of frequently asked questions from such meetings. We try to be realistic and positive

It is useful to invite managers to the informational meetings. Their presence, along with that of the corporate liaison, can serve as a strong sign of support for potential volunteers.

In order to keep track of contact information for all the participants in our projects, EDC has made use of a small database to produce phone and mailing lists for the various groups.

Volunteers needed to teach math at area schools

For those who enjoy problem-solving with numbers, here's an opportunity. Massachusetts Community Relations has been involved with a two-year "Middle School Math Project" funded by the National Science Foundation and developed by the Education Development Center (EDC) in Newton, Mass.

EDC plans to implement an innovative professional development program for middle school and high school teachers during the 1992-1994 school years. The project, "Teachers, Time and Transformations," will enable teachers to explore a coordinated approach to curriculum planning in mathematics. Teams of teachers from the same district will attend seminars during the school year, while volunteers from local companies substitute teach for them.

Volunteers are needed to teach algebra and geometry at Maynard High School and the Fowler Middle School, Maynard, at Marlboro High School and Marlboro Middle School.

Those who volunteer will be asked to commit to 20 Thursday mornings during the 1992-93 school year, a two-day training program and planning time with teachers. A bachelor's degree in mathematics, science or engineering is required.

An informational session will be held on July 16 at 9 a.m in the Acorn Conference Room, MRO3-2. Contact Barbara Sarkisian-Arthur, DTN 275-2475 (QETOO::ARTHUR), for additional information.

Besides Digital, New England Telephone and Polaroid are also participating in this program.•

Figure 4.1 Sample Notice from a Company Newsletter. Source: Digital This Week, *July 1992. Reprinted with permission from Digital Equipment Corporation.*

here, and we also discuss the nature of the training and continuing support we offer to the volunteers who are selected.

We give a great deal of thought to placing minority volunteers, since they can be powerful role models for minority students.

Of course, the primary goal of such a meeting is to inspire people to join us, and we want them to know that it's fun to work in this program. But we also want volunteers to be informed by a sense of the responsibility they are taking on as well. We try to make the informational meeting reflect both of these perspectives. We also give all meeting participants a packet that includes information about the program (see items A-5, A-6, A-7, and A-8 in the Sourcebook), and we invite them to apply for an assignment. When it seems appropriate, we conduct interviews with some of the potential volunteers at the end of the informational meeting; otherwise, we return to the site for a series of interviews later on.

Recruiting Volunteers in Companies with No Centralized Facility

When we worked recently with NYNEX, we were unable to set up a central informational meeting for volunteers because of the physical distribution of their personnel services departments and facilities. Therefore, we depended much more on the corporate liaison to help us contact potential volunteers.

Company contacts first advertised the project throughout the corporation by means of the company newsletter and other company-wide announcements. A member of the NYNEX human resources office then sent us a list of potential volunteers, including information on their department, degree, and teaching experience. We scheduled interviews from this list. This method added several layers of complexity to the recruit-

ing process, but the corporate liaison was quite helpful in finding people well suited to the project. Because of the number of locations involved, we eventually conducted many of the NYNEX interviews at EDC, rather than going to the different work sites.

Interviewing Potential Volunteers

Placing industry volunteers in the schools requires that you screen people to make sure their abilities are appropriate for classroom work. Some people are more comfortable in classrooms than others, but their own self-selection is sometimes not enough to ensure this. In the EDC projects, we conduct formal interviews with each person who volunteers for the program, and we let each person know that not everyone who applies is assigned to a school. (Sourcebook item A-9 presents a list of sample interview questions.) During the interviews, we again clarify the commitment volunteers are making to the program.

Our most important goal is to recruit people who are flexible and who approach new tasks in a spirit of good humor and receptiveness. We have found that teaching experience in adult settings is not necessarily helpful for our volunteers, although some experience with schoolchildren (scouting, coaching, etc.) is usually beneficial. Figure 4.2 presents suggested criteria for selecting good volunteers. These criteria began with our own list, which we gave to a corporate partner's human relations team. Those team members added the items in the second half of the list to reflect the company's own vision of the kind of employees it wanted to offer us.

It is important to let volunteers know as soon as possible that they have been assigned to a classroom. Vacations and other summer interruptions can take people away during the summer and cause them to miss a late-arriving notification.

Placing Volunteers in Classrooms

When we are sure of the number of classrooms we need to fill, we assign a pair of industry volunteers to a particular teacher, with whom they will work throughout the year. We try to accommodate specific preferences as to a volunteer's co-teacher, the school's location, and the students' grade level.

Organizers need to honor preferences related to the pairing of volunteers. Some volunteers prefer to work with people they know, while others find it more interesting to be paired with people whose expertise and experience are different from their own. We've recently been seeing that volunteer co-teachers who work in the same plant seem to benefit from frequent access to each other and from the chance to meet regularly about the classroom work. These teams seem to plan together more and try more inventive things. When assigning pairs, we try to keep this physical proximity in mind.

Some industries request that their employees volunteer in the towns where they have facilities, and some volunteers wish to be placed close to work or home. Students' grade level can also be a consideration for those volunteers who have a sense of what age-group they relate to best.

Suggested Industry Volunteer Qualifications

EDC List

1. Previous work with adolescents, either outside or inside of schools (e.g., tutoring, teaching, coaching)
2. Knowledge of pre-algebra, algebra, and geometry
3. Undergraduate or graduate degree with concentration in mathematics, engineering, science, economics, or business
4. Positive feeling for adolescents
5. Comfort in setting limits
6. Flexible working style
7. Sense of humor and patience
8. Willingness to support teachers and schools

Criteria Added by Digital Equipment Corporation

- Desire
- Ability to be a role model, based on urban school needs
- Communication skills
- Demonstrated ability working with children
- Love of math, understanding of content, and ability to show relevance to the "real world"
- Management support for individual to meet requirements of both business responsibility and volunteer assignment
- Although there are no educational requirements for substitute teachers in Massachusetts, a B.S. in elementary education, math, science, or engineering is recommended

Figure 4.2 Criteria for Industry Volunteers

Once selected, the volunteers are contacted first by phone and later by letter to advise them where they will be teaching and what grade level they will be working with. We also remind them of the dates for the orientation and training sessions. Sourcebook items A-10 and A-11 provide sample phone scripts and a letter for informing volunteers of their selection. We also furnish the corporate liaison with a list of the volunteers selected from her or his organization.

5

Training Industry Volunteers

Many teachers are reluctant to leave their classrooms in the hands of strangers, especially strangers who have little training as teachers. Your industry volunteer project can address this reluctance by informing the teachers of the thorough preparation and support you give the industry volunteers. In the EDC model, we commonly require two days of training before the volunteers take charge of a class.

When we design training workshops, we seek to provide safe ways for the volunteers to share ideas, work out their own misgivings about modern education, meet their volunteer co-teachers, and meet their classroom teachers. We also provide food, adequate breaks, and plenty of time for discussion.

Training Schedule

Session 1	***Thinking about Good Teaching (half day)***
	• Introductions
	• What's a good teacher?
	• Video of an industry volunteer teaching in the classroom
	• Meet your volunteer co-teacher and the classroom teacher
Session 2	***Thinking about Managing a Classroom (full day)***
(a.m.)	• Visiting your classroom teacher (classroom observations)
(p.m.)	• Debriefing after classroom visits
	• Approaches to discipline
	• Advice from veterans (industry volunteers and a classroom teacher)
	• Preparing for the first day

Figure 5.1 Typical Volunteer Training Schedule

"It has been incredible! [The industry volunteers] are wonderful people, and the kids love them. At first they did my lessons, but now they're doing their own, about telephone equipment. They are such good images for my kids of successful people who use math in their jobs!"

A classroom teacher

As the typical schedule presented in Figure 5.1 shows, the first day is spent getting acquainted with the program and thinking about modern school cultures, which are often dramatically different from the volunteers' own experience. Then later, on the same weekday designated for the teacher seminars, the volunteers spend a morning observing their classroom teacher; meeting students, principal, and office staff; and becoming familiar with the school. This site visit is followed by an afternoon training session at which the volunteers are encouraged to reflect on what they have observed.

Fundamentals of Industry Volunteer Training

The partners in an industry volunteer project — the corporate partners, the schools, and the project organizers — must remember that the volunteers are *not* teachers; nor can they be made into teachers in a couple of days of workshops. We start with the volunteers' own experience as a way of helping them find effective and positive ways to share their industry expertise with students in a classroom setting. Our training sessions are intended to address several specific outcomes for the volunteers:

Training session agendas can be found in the Sourcebook (see Sections B and C).

- To construct a picture of education in today's schools
- To become familiar with their assigned school
- To learn adequate skills for sharing their expertise with classes
- To look realistically at their fears about teaching
- To become familiar with their roles and responsibilities in the project
- To experience a positive learning environment

Specific Training Outcomes

Although myriad activities could be used to achieve these outcomes, we will discuss here several items we use in the EDC training sessions. Detailed descriptions for these activities are included in Sourcebook sections B and C.

It is critical that the project staff remember the names of the volunteers they have interviewed. An open and friendly atmosphere for the day is established when people walk in and are immediately called by their names.

Constructing a Picture of Education in Today's Schools. Volunteers may have distorted or romantic views of what goes on in modern schools, so our first task is to help them construct a more reasonable view of the goals and practices of contemporary education. Our purpose here is to help the volunteers see a variety of ways of viewing school success and to assist them in correlating an industry view of school with an educator's or a student's.

An early activity that we call "The Great Divide" helps volunteers understand the mismatch that may exist between the various interest groups concerned with education. We discuss a survey sponsored by the Committee for Economic Development (CED) that asked parents, stu-

dents, college educators, and industry representatives about their beliefs concerning the preparation of today's high school students for work or college. In training volunteers for math courses, we focus on the questions relevant to quantitative ability, but the survey also covers other issues, such as writing skills, ability to concentrate, reading skills, and the ability to follow instructions.

Some of the results from the CED survey can be found in the Sourcebook (see item B-5).

After volunteers complete some of the survey questions according to their own experience, we tally the results and compare them with those of the survey. This activity underlines the mismatch the volunteers themselves may have with what others expect from schools. We hope that the volunteers will see their class visits as ways to bring these views closer together.

Volunteers' memories of their own good or bad teachers form the backdrop for another activity intended to highlight the assumptions about good teaching they bring to the project. In the "Ideal Teacher Drawing" activity, volunteers, in small groups, produce a wall poster that illustrates the qualities of their ideal teacher. The activity combines introspection, group discussion, and peer collaboration to focus on these assumptions.

"Our ideal teacher is all-knowing, smiles a lot, and has quite a few wrinkles (from experience). We put in a strong voice, a strong stomach, and a strong hand. But note that the other hand is open and that the heart is very big. The large pelvis comes from being 'hip.'"

A volunteer's description of his group's wall poster

Another activity helps volunteers articulate the basic purposes of education by exploring the reasons schools exist. The small group at each table contributes to a common list. This discussion is intended to get volunteers to think about the consequences to societies and individuals when these functions are neglected.

To give the volunteers a first taste of what it may be like to work with students, we generally show videotaped excerpts from a lesson being taught by a volunteer from a previous year. In these segments, a volunteer presents a lesson from work and uses a classroom technique, such as group work or a hands-on activity. We ask participants to notice things about the students, the volunteer, and the interaction between them.

The video samples offer rich discussion starters on such topics as handling show offs, being flexible, and turning student responses into "teachable moments."

Becoming Familiar with a Local School. Before they come into a class on their own, we consider it essential for volunteers to observe their classroom teachers interacting with the students. The second training day begins with visits to the classrooms where the volunteers will eventually teach; these classroom visits serve to strengthen the position of the volunteers with the students while offering the volunteers a chance to see how the teacher manages the classroom.

The list reprinted as "Homework" in the Sourcebook (see item B-12) guides the volunteers to take note of the physical plant, options for discipline, classroom routines, and the ways expectations for students are communicated.

Industry volunteers have more success when the students come to understand that they are not ordinary substitute teachers. A natural consequence of the classroom visits is a chance for the teacher to explain the industry volunteer project to the students. Classroom teachers who greet the volunteers warmly and express confidence in their expertise give students a view of the volunteers as a regular part of the classroom team — a student perspective that is especially beneficial to the volunteers.

In their own space, teachers can also talk directly to the volunteers

We imply regularity by referring to the classroom days as "alternate Thursdays." In practice, it is not always possible to keep to a strict biweekly schedule; however, all teacher sessions are scheduled for the same day of the week to accommodate the rotating schedules used by some middle and high schools.

Having volunteers visit on their regular day of the week is especially important in middle schools and in some high schools, where daily schedules can vary a great deal. The volunteers will sometimes be responsible for moving students around a school for specialty lessons in foreign languages, science, or physical education. As far as possible, their observation day should look like the one the volunteer pair will see on a regular basis.

explaining subject matter goals, unusual circumstances (e.g., gifted or mainstreamed students), and other essentials such as the locations of the bathrooms and the teachers' lounge. They can see how the students and volunteers seem to match up, include them in group work, or comment on the day's results.

During these class visits, volunteers learn a great deal. They see the daily schedule in action; they see a teacher's classroom style and behavior limits first hand. They meet the staff and the teachers next door. They may notice dozens of other surprising things — the potential for exhaustion, the range of student responses, how fast/ slowly the time can go, the fragmentation of a typical student's day, the difficulty of holding students' attention. They also learn that the rules have changed since they were in school. We especially emphasize the need for the volunteers to meet the principal, a person whose responsibility for both the students and the classroom teachers involves a deep concern for the sort of day the volunteers have with the students.

At the afternoon training session that follows their classroom observation, volunteers arrive excited and eager to talk about what they have seen. The opening debriefing is designed to help them cope with the challenges they have witnessed. We encourage discussion of such issues as ways to learn student names, classroom rules, the level of work they can expect, students' particular needs, the classroom atmosphere, and any other questions they bring.

Learning Strategies for Sharing Industry Expertise. One of the main goals of using industry volunteers, instead of traditional substitutes, to release teachers is to provide students with exposure to representatives of local businesses and industries. Therefore, we intend for the training to enhance volunteers' ability to share their expertise with students in a classroom setting. We deal with this issue in two ways: by reminding volunteers of what they have to offer, and by giving them a few basic skills with which to communicate that expertise.

Industry volunteers are not being asked to bring great teaching talent to the classrooms; we ask them instead to share their experience as employees, and to establish a connection between the two worlds of school and work. Thus, our training sessions are designed to give the volunteers an awareness of the value of their experience to students, and some classroom management skills to enable them to share that experience.

Among the classroom skills we emphasize are setting expectations, keeping attention, and helping students learn together productively. Veteran volunteers and a representative classroom teacher also offer a few reliable techniques for keeping a classroom orderly.

One teaching strategy we bring up in the first training session is the correlation between teacher expectations and student performance. For this segment, we depend on a mini-lecture accompanied by a handout.

We also conduct an elaborate segment on cooperative learning. We point out the advantages of naming specific outcomes for group work

and of assigning roles to each group member. After giving groups of volunteers a problem challenging enough to engage their concentration on a task for up to 20 minutes, we discuss the teaching value of such group activities, using their own experience as an example.

We spend a good deal of time in the second training session discussing classroom discipline. One approach we use is to outline several useful theories of discipline from educational psychology. In this, one of our staff members presents a sketch of the major theories and the advantages of each. We then open the discussion for work on a list of hypothetical classroom dilemmas related to discipline.

We also discuss strategies for learning students' names quickly. This is no small achievement for a volunteer assigned to a morning with three or four different classes of 35 students each.

Background for the "Teacher Expectations" activity comes from Jon Saphier and Robert Gower, The Skillful Teacher *(Carlisle, Massachusetts: Research for Better Teaching, Inc., 1987.)*

Dealing with Fears. We weave space for talking about volunteers' fears throughout the training sessions both in open discussions and in conversations in the breaks. But we also formally address this issue by inviting veteran volunteers and classroom teachers to the last training session. Although veteran volunteers are welcome to the whole training set, most of them come only to the last hour or so of the final session. There, we ask several of them to talk about their experience, and take questions from the new volunteers. The new volunteers tell us that talking to the veterans is particularly helpful.

We also invite classroom teachers who have experience with industry volunteers to talk to the group about their perspective on the experience. Their positive reports and encouragement go a long way toward giving the new volunteers confidence as they begin.

"Don't expect to be a professional teacher — we're not. You will be much more successful if you think of yourself as an envoy from the business world, bringing real-life math to the students."

A veteran volunteer

Understanding a Volunteer's Responsibilities. Throughout the training sessions, volunteers are learning more about what is expected of them. To increase awareness of their responsibilities for helping the program run smoothly, we use three activities.

During the training sessions, we distribute the volunteer expectations list reproduced in Chapter 6 and discuss its importance. We also distribute a handout that guides volunteers in collecting the vital contact information they will need for their volunteer co-teacher and their classroom teacher.

The third activity related to volunteer responsibilities concerns working with volunteer co-teachers. Here we offer suggestions on how other volunteers have managed their co-teaching arrangement, and we reserve a space of time in which we ask volunteer teams to discuss a possible strategy for working together. Volunteers usually divide teaching responsibilities with their co-teachers in one of these ways:

1. One teaches while the other roams and deals with paperwork. Roles may be exchanged when class periods end.

2. Both teach at once. This arrangement, a sort of tag-team approach, is sometimes used by volunteers who know each other well.
3. The volunteers divide up the class load among themselves, one taking pre-calculus and the other pre-algebra, and so on.

We encourage the volunteers to try any pattern that is comfortable for them both. Even though such plans must sometimes be altered as the project evolves, it is useful for the co-teachers to begin talking to each other about such procedural matters early.

In our favorite method for quieting a classroom, the activity leader raises a hand when it is time to come to order and everyone in the room also holds up a hand and stops talking. This strategy provides one way to avoid shouting in order to redirect class attention after group activities.

Experiencing a Positive Learning Environment. The whole training agenda is designed around (a) reminding the volunteers of what it feels like to learn in a classroom setting, and (b) modeling the best teaching strategies we know how to use.

We pay special attention to ways the training staff can model good teacher attitudes, demonstrate ways of pacing the activities, and make space for differing opinions in discussion.

Volunteers are asked to become active participants in the training sessions from the very beginning. This establishes a pattern we hope they will adopt for their own classes, and one we try to model — staying away from extended lectures.

Volunteers should not leave the first training session without essential contact information (phone numbers, addresses, schedules, etc.) for their volunteer coteacher and their classroom teacher.

We're especially interested in helping the volunteers learn to depend on and learn from their peers. Since the industry volunteers assigned to the same school may not already know each other, we seat them at tables with the other volunteers from the school where they will be teaching. Many of the activities use these "table groups" for cooperative learning experiences that serve to vary the pace of the training sessions. We are also careful to have our materials ready when we introduce activities.

In all the ways we can, we try to make the training sessions a profitable and pleasant experience for the volunteers so that they will be able to use what they see and feel, as well as what they "learn," to inform their approach to their own volunteer teaching.

6

Expected Contributions from Program Participants

The industry volunteer model builds collaborative programs based on shared responsibilities among the corporate partners, the schools, the volunteers, and the teachers. For the projects to work, all the participants in the effort must know what is expected of them and be willing to do their part. This section details these shared responsibilities.

Corporate Partners' Responsibilities

We ask our corporate partners to release their employee volunteers for a specified number of hours for training, classroom observation, and teaching. Over the course of a year, a corporate partner donates approximately 85 hours for each volunteer. Most of the companies agree to participate in the project with the understanding that their employees will not be asked to sacrifice their on-the-job responsibilities. The two statements printed in the margins, here and on the next page, indicate the possible levels of commitment amid the realities of the work world in different sorts of companies.

Corporate partners also agree to support their employees' involvement. Some of the most important support for the volunteers comes from their home company, where recognition of volunteers' commitment to the program goes beyond releasing them to participate. Corporate partners have given their volunteers recognition at company business meetings, through volunteerism awards, and by mention in an employee's annual performance review. One company honored the EDC team and its volunteers with a special educator award luncheon. All our corporate partners have been happy to include reports on the project in company newsletters and e-mail bulletins.

Participating Schools' Responsibilities

We work closely with the participating schools in the selection of teachers for the professional development seminars and discuss with the

"Our company has committed to support three schools during the pilot year, two volunteers per school, with an available resource pool for backup. The plan indicates that the size of the program will double in year 2. It has been suggested that we establish two volunteer teachers for every teacher so our employees can partner up, share the teaching schedule, and have time for some creativity. We have decided to recruit six co-teachers for the designated schools and establish a resource pool of volunteers who can back up the coteachers in case of illness or scheduling problems."

A corporate liaison

schools their role in the industry volunteer model that supports the teachers' involvement. The school staff's primary responsibility is to help the volunteers succeed while the classroom teacher is away. Local school principals and the classroom teachers' colleagues are usually supportive and eager to talk with the volunteers during breaks or over lunch. Some principals write personal letters of thanks to the corporate partners and the volunteers.

"As you know, we were inundated with employees who want to tutor middle school math next fall. It looks like you'll be getting some great volunteers. Because we change jobs so frequently within NYNEX, there is no guarantee that people who are available now will be able to get away from work to teach next fall. Therefore, I'm sending the names of all Massachusetts employees and have put an asterisk beside those who seem especially qualified. If it turns out they are not in fact available, we can help you by sorting through the other volunteer names to find good candidates."

A corporate liaison

Industry Volunteers' Responsibilities

The volunteers themselves are the center of our efforts to provide teachers with a comfortable way to be out of their classrooms for professional development projects. The volunteers' first responsibility is to be reliable. We introduce the expectations list (Figure 6.1) early in the volunteer training sessions.

As the list indicates, we also expect the volunteers to be reliable colleagues for their volunteer co-teachers. In the training sessions, we spend time helping the volunteer pairs articulate their teamwork strategy and think about what it means to work with a co-teacher. Most of the pairs arrange some form of rotating responsibility for the different parts of the school day. A few exchange roles from week to week, but we expect both volunteers to be present in every class.

Of course, one reason for assigning volunteers in pairs is that now and then emergencies arise in which one of them cannot be present. Expectation 2 (on whom to call about absences) helps project organizers foresee problems with a volunteer's ability to meet regularly with the class.

Expectations for Volunteers

1. We expect you *and* your industry co-teacher to be present at all of the classes scheduled.
2. We expect you to call your classroom teacher first, your industry co-teacher second, and then us at EDC if you will be absent for any of the teaching days.
3. We expect you to communicate with your classroom teacher before each teaching day to discuss your upcoming lessons.
4. We expect you to keep us informed if there are problems with your placement.
5. We expect you to have a wonderful experience!

Figure 6.1 Industry Volunteer Expectations Handout

Because it is not always possible for the corporate partners to avoid job changes for volunteers, we ask volunteers to keep us informed if their jobs change in such a way as to threaten their involvement.

Of course, we also expect the volunteers to do their best to make their classroom participation profitable and interesting for the students, and we hope they will create at least a few of their own lessons in collabora-

tion with their volunteer co-teacher and their classroom teacher.

We have seen several examples of volunteers who provided positive feedback and encouragement to the classroom teachers, in the form of respect for their work and letters of appreciation.

Classroom Teachers' Responsibilities

As the direct link between the industry volunteers and the students they will work with, the classroom teachers have a responsibility to distinguish the volunteers from ordinary substitutes. We have developed a list of suggestions for how the teachers should introduce the volunteers to their students. This list (see item A-12 in the Sourcebook) is a first cut on the responsibilities we ask teachers to assume in regard to the industry volunteer model.

We try to avoid the title "substitute" because of the unstated expectations it raises: teachers may expect a traditional replacement model, volunteers may expect to be merely filling up time, and employers may think it's ok to pull out key volunteers when their work gets heavy.

We expect classroom teachers to support the volunteers by building student respect for the volunteers, providing lesson plan support, helping volunteers with local rules, and giving simple encouragement. It is essential for the classroom teachers to help the volunteers find a workable pattern for regular conversations about classroom affairs. Some teachers and volunteers find regular phone conversations sufficient, but others find it helpful to meet at the school in the mornings, after the teaching days, or at some other time. A few report to each other primarily through written notes.

Teachers can protect the integrity of the volunteers by trusting them to establish their own classroom climate while the teacher is away. It is also useful for the classroom teacher to find ways to make the students accountable for the learning that took place with the volunteers and to let students know that they communicate regularly with the volunteers about the class. Teachers also need to avoid situations where they have to "re-teach" or "repair" what the volunteers do, and to make only minimal use of threats against students who misbehave for the volunteers.

A list of people willing to serve as alternate industry volunteers is developed during the recruitment and interview phases of the project. It provides backup for cases where industry volunteers' jobs force them to drop out of the program.

Some volunteers prefer that their classroom teacher create lesson plans for the volunteer days, so the volunteers must have their own copy of the class textbooks. Another way to use the industry volunteers' expertise is to have them augment the current subject matter with their industry experience. Some volunteers find informal conversations with the students an good way to share their work experience. Others bring lessons they have designed using examples from their work. The enthusiasm of volunteers multiplies when their workplace lessons engage the students. Teachers who provide space for the volunteers to have positive teaching experiences get far more than their effort returned.

A major trap for substitute teachers in middle grades is to violate local taboos without even knowing they have done so. Volunteers need to be oriented to such local rules when they first visit the classrooms, but there is so much to see on that first visit that they may not remember everything. It is helpful for volunteers to have a list of classroom practices established by the teacher, as well as hallway and lunchroom procedures

they may need to supervise. In the Sourcebook (see item A-13) is a list of procedures one classroom teacher used with her students. She shared this list with the volunteers as well.

Classroom housekeeping can also be quite a distraction for volunteers. Juggling lunch counts, locker breaks, attendance sheets, notes from home, and other classroom clutter can rob the volunteers' time and make a good day seem tedious. Since they work in pairs, volunteers have some resources in each other, but sometimes classroom teachers will assign students to cover these tasks where doing so seems appropriate.

Despite their bravado, a traditional day with any substitute can be hard on students, and they may wait to see what happens with these strangers. If their teacher introduces the volunteers with enthusiasm, they are usually accepting of the arrangement.

Like all of us, industry volunteers thrive on respect for their work. Some are particularly interested in knowing about their teacher's activities during the released time because such information reinforces the classroom partnership and makes the strenuous work worthwhile. Teachers need to remember that the work *is* strenuous for most of the volunteers. They face sustained pressure, constant demands for attention, and the stretch to do a tough job that is quite different from their usual work. These pressures and the prospect of catching up on their own work all afternoon can combine to make for an exhausting day for the volunteers. They respond well when someone notices.

7

Keeping Things Running Smoothly

After the program has been established and the volunteers have begun their regular classroom work, the primary responsibility for making sure that everything runs smoothly falls to the project organizers. EDC project organizers keep close tabs on the status of the volunteers' progress through regular phone contact with the entire volunteer corps. At least twice during the year, an EDC staff member surveys all the volunteers by phone. (Of course, volunteers also have carte blanche to call us any other time as well.) The first set of contacts is made quite early in the project so that we get an idea of how each volunteer is doing.

These planned contacts provide us with a good sense of the triumphs and traumas encountered in the classes. They also give volunteers a place to speak up if they are anxious about their current results. Generally, the volunteers tell us about their most recent positive experience. We also maintain contact with the companies, keeping them up to date on the overall program.

A midyear gathering of the volunteers with all the classroom teachers has been a feature of our programs. It focuses on time for social exchange and sharing of successes and struggles, and it provides opportunities to ask for and give advice. Our present roster of volunteers are asking for more extensive midyear training sessions. Such sessions could take advantage of volunteers' current experiences in ways that the early training sessions cannot; however, in the past we've found it difficult to schedule even short meetings. We prefer instead to encourage the teachers and their volunteer teams to find time somewhere near midterm to meet with each other for extended updates and planning.

When volunteers ask for help with lesson design, pacing, or ways to motivate students, we sometimes set up individual meetings with them to explore teaching strategies appropriate to their specific needs.

We also keep a file of sample industry lessons that volunteers can use as models for their own design of class projects. A good model has a specific teaching goal, an activity for the students, and uses materials, circumstances, data, or problems from the volunteer's own work experi-

> *"Early reports from teachers and organizers indicate that once again there has been a range of experiences with industry volunteers. . . Most teachers we talked to say 'things are going fine.' A few volunteers have had to be replaced, but EDC's dogged commitment to making this aspect of the project work has kept them resourceful and good-humored in the face of these and other problems."*
>
> A project evaluator

ence. Figure 7.1 illustrates the range of topics our volunteers have brought to their classes. Several of these lessons devised by volunteers are reproduced in the Sourcebook (see Section D.)

Lessons Created by Industry Volunteers

- Code breakers*
- Logic gates lesson*
- Statistics from class data*
- Estimating production schedules
- Number systems: translation from the decimal to the binary system*
- City planning math project*
- Party Budgets*
- Calculating electrical current for a circuit* (a division problem)
- The infamous peanut butter and jelly experiment (a computer programming problem)*
- What is in a computer: ROM, circuit boards, chips, floppies, Nintendo
- Developing a problem solution: the 5-step programming method
- Techniques of color photography
- Symmetry
- Finding defects in film
- Fiber optics
- Baud rates
- Percentages applied to the real world
- Designing games for computers
- Robotics
- What's inside a computer
- How a telephone works
- Converting square feet to cubic yard
- Finding the circumference of a wheel
- Finding cost per square inch of pizza
- Understanding an oscilloscope
- How much paint to buy
- Solving equations by problem solving
- Determining a production schedule based on machine times

* Full lesson included in Sourcebook Section D

Figure 7.1 List of Lessons Created by Industry Volunteers

A project organizer's primary job is encouragement and maintenance. We take the approach that volunteer lessons that appear to crash-land are not necessarily failures but, rather, honest attempts to try something new. We remind volunteers that any day's content is not all we expect students to learn from school, and that their own presence contributes to the class in unique ways. When discouragement threatens to swamp a volunteer, we sometimes schedule a classroom visit to help diagnose the trouble.

Our other responsibility is to encourage exchanges and support between the businesses, the teachers, and the volunteers. We also maintain regular phone contact with the corporate partners and the local schools to make sure the project is on track and to address problems before they become serious.

Troubleshooting

Our most pressing problems are related to volunteers who find they cannot continue with the program. New job assignments or promotions sometimes move people out of the area. Large-scale employee layoffs can

cause major shifts in volunteers' time demands even when they are not the ones let go.

We are convinced that our thorough recruiting practices are responsible for the small number of volunteers who have asked to leave because of difficulty with the classes themselves. Our practice is to choose alternate volunteers who agree to join the project if someone is forced to drop out. Those alternates must have some training, however, so some alternates agree to attend the training from the beginning of the project. At other times their training is handled one-on-one with an EDC staff member.

Corporate commitments are generally made by people other than the volunteers' direct supervisors. Informal approval from these supervisors must sometimes be actively sought. In such cases, the EDC project staff works to intercede with the company where possible. Sometimes the corporate liaison will also intercede on the volunteer's behalf.

A few of our volunteers have reported that their colleagues were resentful that they were absent from the job for this project, and one said that their colleagues viewed it as "time off." Some of the volunteers have talked about pressures on the job and working 60-hour weeks, but fortunately, these seemed to be problems for only a small number of the volunteers. Reminding the supervisors of the value of the project can sometimes help in this area. It is also good to remind the corporate liaison how important it is for the work of the volunteers to be recognized by the company.

In a few cases, volunteers have encountered unsympathetic school officials who feel, as the employees' supervisors sometimes do, that this is an extra "day off" for the classroom teacher. In other cases, the volunteers have been caught in the middle of unpleasant conflicts between the classroom teacher and the school. As project organizers, EDC staff members act as mediators in such situations where doing so is appropriate. We act as an advocate for the volunteer in such conflicts.

Now and then, volunteer co-teachers find their classroom match-ups unworkable. Differences in approach to the students or disagreements over work styles sometimes force us to adjust volunteer assignments. In one case, we transferred a volunteer to a different school, and in another, the volunteers chose to divide the classroom responsibility, each one working alone. Such difficulties are not surprising with a group such as this, but they have been relatively rare. Whenever they do occur, we try to work out the best solution possible for both the volunteers and the students.

The toughest troubleshooting problems usually represent the sort of discipline issues that all good teachers face in today's schools. Troubled teenagers and those resistant to *any* authority are not always attracted to the volunteers. Even so, some students otherwise bored by school find the presence of industry volunteers stimulating and positive. On balance, we deal with relatively few serious discipline problems that the volunteers cannot work out with the students, either on their own or with the help of their classroom teacher.

"They showed us how you really use this stuff later on — REALLY."

A student

"It was neat to learn how math is used in making cameras."

A student

When one industry volunteer's manager gave her trouble for being "gone" too much, our staff members reminded the manager of the value of this project and secured a more supportive atmosphere for the volunteer.

8

Evaluating Program Results

Systematic evaluation of your industry volunteer project provides a way to check on the progress of the project's original goals and offers feedback for improving the program in subsequent years. Formative, ongoing evaluation is highly recommended.

Correlating Evaluation to the Project Goals

Various instruments can be used to evaluate the results of your project. But a sensible way to choose appropriate measures is to base them on the goals set in its initial stages. Projects that emphasize corporate volunteerism or business involvement in local schools should be evaluated on the degree to which these goals are met. Projects focused on teacher development should look at what happens to the teachers as well. Those which emphasize increased exposure of students to workplace use of their subject matter should look at these results for the students.

It is likely that any project organizers will want to know something about all of these areas, but different sponsorship may call for different levels of emphasis for them. The EDC programs explore all three areas, but emphasize the results for teachers, since our industry volunteer model is used in the service of specific teacher development programs.

With grant support, EDC usually hires professional consultants to conduct independent evaluations of teacher projects. To assess a project's industry component, the evaluation group may interview teachers or send questionnaires to industry volunteers and students. According to our evaluators, most of the teachers believe that their students are benefiting from the learning experiences provided by the industry volunteers. They also believe that students will profit in the future from what the teachers are learning in their seminars. The evaluators also tell us that the real success of these projects rests on the teachers' willingness to leave their students in the hands of our volunteers.

> *"No one said they were reluctant to leave their students with the volunteers, and only one teacher said he felt behind in his curriculum because of his absences from the classroom every other Thursday morning. These findings are wonderful! They strongly attest to the efficacy of this innovative model."*
>
> *A project evaluator*

Using Evaluation Results

Results of project evaluation can be valuable tools in making intelligent adjustments to a program or in designing subsequent projects.

Early evaluations of EDC industry volunteer projects showed that the industry volunteers needed more peer support from each other. Thus, in subsequent years we have assigned volunteers to classes in pairs and have increased the opportunities for contact between new and veteran volunteers. These changes have resulted in significant improvements in the volunteers' success rate and have become major features of the model. We have also made adjustments in the training program and in the nature of our reports to the corporate partners and liaisons as a result of comments from the evaluators.

Section E of the Sourcebook contains sample evaluation forms used by some of our evaluation teams.

> *"For most of the volunteers, having a partner was worthwhile and helpful. Most said they liked having another adult in the room, even if they alternated teaching. One of the volunteers wrote that he thought it was very important for the students to see adults working cooperatively! . . . It seems clear from teacher and industry feedback that the teaming should continue."*
>
> A project evaluator

9

Sourcebook

The resources included in this part of the handbook have been derived from the various EDC projects in which the industry volunteer model was used to fund teacher released time.

In most cases, these materials refer to EDC project conditions and should be thought of as models that you can adapt to your own situation. You are welcome to use any of them that you find helpful.

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A

Materials for Getting Started

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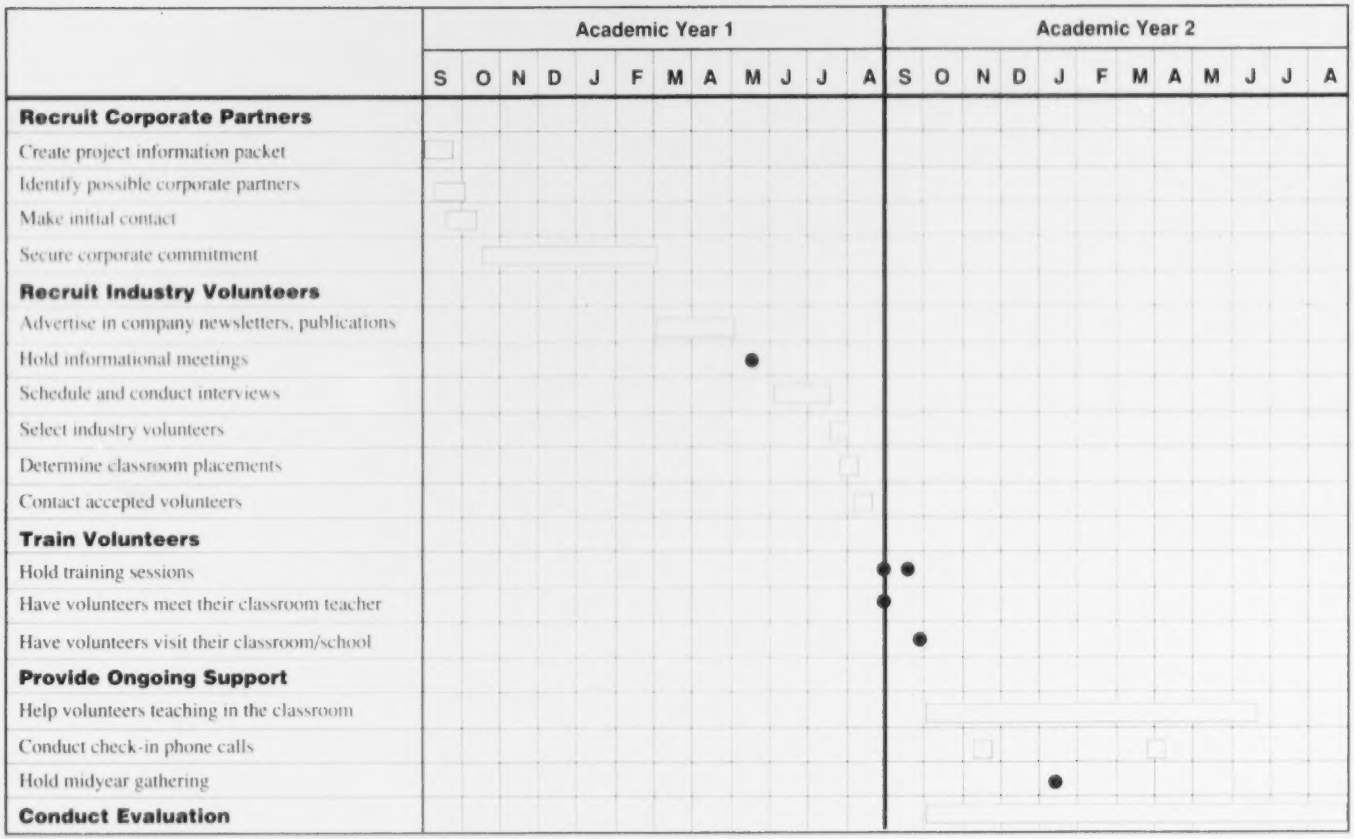
A-1 | Sample Timeline


Academic Year 1
Academic Year 2
S O N D J F M A M J J A S O N D J F M A M J J A
Recruit Corporate Partners
Create project information packet
Identify possible corporate partners
Make initial contact
Secure corporate commitment
Recruit Industry Volunteers
Advertise in company newsletters, publications
Hold informational meetings
Schedule and conduct interviews
Select industry volunteers
Determine classroom placements
Contact accepted volunteers
Train Volunteers
Hold training sessions
Have volunteers meet their classroom teacher
Have volunteers visit their classroom/school
Provide Ongoing Support
Help volunteers teaching in the classroom
Conduct check-in phone calls
Hold midyear gathering
Conduct Evaluation

A-2 | Sample One-Page Project Description

"A Mathematics Staff Development Project for Teachers Grades 4 – 12"

Education Development Center (EDC) is offering an opportunity for teams of teachers from seven school districts in the Greater Boston area. This exciting three-year project — *Teachers, Time, and Transformations* — will enable teachers to explore a coordinated approach to curriculum planning in mathematics. Teams of teachers from the same districts will attend seminars during the school year to focus on

- materials and pedagogical techniques to enhance the learning of mathematics
- mathematical themes that run across grades, especially concerning the learning and teaching of algebraic concepts
- a coordinated effort to maximize a smooth transition from elementary to middle to high school
- new curriculum projects being developed nationally

While the middle and high school teachers are attending these seminars twice monthly at EDC, they will be replaced in their classrooms with industry substitutes from Polaroid, NYNEX, Digital, and GTE Laboratories. (Elementary teachers will join middle and high school teachers for five of these seminars; the project will cover the cost for in-house substitutes for these teachers.)

What is the commitment from industry substitutes? We will be placing, whenever possible, two industry substitutes in each classroom. You will be in the same teacher's classroom each time, and you will be responsible for teaching these classes two half-days (Wednesday mornings for the 1993 – 1994 school year) per month (we will expect you to sign on for a minimum of one year). If possible, we would like you to bring examples of what you do on your job to some of these classes so that students have a better understanding of how mathematics is used in real life.

What are the qualifications needed by industry substitutes? Ideally, we would like you to have at least a bachelor's degree in mathematics, science, or engineering. Since you will be substituting in a middle or high school mathematics classroom, we would like you to have a working knowledge of algebra and geometry (or be able to brush up on them with little effort!).

Who is running the project? The project is located at EDC, a nonprofit research and development organization. The project director is Faye Ruopp, the associate project director is Grace Kelemanik, and the senior scientist is Al Cuoco (all from EDC — 617-969-7100). Funding for the project is from the National Science Foundation.

What training will be offered? EDC will offer two days of training in September for industry volunteers, to acquaint them with the realities of teaching and schooling and with other pertinent issues concerning their co-teaching.

A-3 Industry Volunteer Informational Meeting Agenda

1. Introduce staff — project director, associate director, industry volunteer.

2. Explain history of the project:
   - Previous grant — to explore content of algebra at middle school level
   - National statistics — one-third fail algebra; algebra is gateway course
   - Needed a cost-effective model for teacher training
   - Industry connection
   - Model in place for two years with great success — teachers' comments

3. Outline new proposal:
   - Coordinated look at curriculum — isolation of teachers by grade
   - Algebra for everyone
   - Middle and high school classrooms (they can choose)

4. Present positive results of project:
   - Teachers have commented that this has been one of the best professional development experiences in their careers.
   - Many teachers have taken a new look at their teaching — evidence of change in their classrooms.
   - Industry employees have a firsthand look at what it's like to teach and learn — and are able to share with students what they do on their job.
   - One industry person is going back to school to teach.
   - Requests from different parts of the country to replicate the model — there is a dissemination component in the third year of the project.
   - Students have gained role models, have learned about industry, and have learned new math techniques.

5. Have the veteran industry volunteer talk about her or his experience.

6. Review packet of materials.

7. Provide lots of time for questions.

A-4 | Questions Frequently Asked by Potential Industry Volunteers

*[**NOTE:** Responses by project director (PD) and veteran industry volunteer (VV).]*

Q. ***How many different classes will I have to teach?***

PD: Somewhere between two and four, and they might be different curricula.

VV: It's tiring. I'm often more tired after a morning of teaching than I am after a whole day of work!

Q. ***How much preparation time is needed, in addition to the eight hours per month that I'm in the classroom?***

VV: One hour for each of the first five or six classes. After that, I often use the time between classes for preparation.

PD: Some teachers leave lesson plans. They usually get you the books ahead of time. The high school math classes tend to be more content-oriented than the earlier grades. Overall, plan about one hour per session. And tell all your kids about what you do in your job and how math relates to it.

Q. ***Can I team up with someone ahead of time, such as someone from my company?***

PD: Yes. Specific requests are granted whenever possible, including which schools and what grades.

Q. ***Will I meet with the teacher ahead of time?***

PD: Yes. And you'll observe the teachers with their classes ahead of time, too.

Q. ***Will I have the same authority as the teacher?***

PD: It's very important for the teacher to bestow her or his authority on you in front of the kids.

VV: It helps if you really call the parents and use the blue slips too!

Q. ***Will our managers know what this is all about?***

PD: Yes. The corporate liaison will help ensure that the relevant "chain of command" is supportive.

Q. ***If we've never taught before, how will we know what to do?***

PD: EDC will help prepare you, the teachers for whom you substitute will help, and, of course, you might fail. But the main thing is just to communicate that you love math, you love your job, and why it's important to do well in school — because the kids really need to hear it.

Q. ***Can we get access to an accumulation of good lessons, things that worked?***

PD: The textbooks will contain some helpful material. Also, EDC has an extensive library, but the materials have to be matched with the specific task at hand.

Q. ***Do the classrooms have computers?***

PD: Most don't, and computer labs are usually quite inaccessible. This varies considerably among different school districts.

VV: There's an incredible lack of technology in the schools; many even lack paper and other basic supplies. I arranged for my company's surplus program to donate old computers to schools, and I felt like Santa Claus!

Q. ***Is there a willingness to learn? Are the kids interested?***

PD: *All* the kids want to learn new things. But what conduit you use to get it to them makes a big difference.

A-5 | The Collaborative Process

- The project is based on a collaboration of educational developers, schools, and the private sector.
- School districts will provide released time for teachers to participate in the seminars.
- Corporate partners will provide released time for employees to serve as replacements for classroom teachers on seminar days
- Industry personnel will get a firsthand look at the challenges facing school systems in the 1990s.
- Opportunities to experiment with teaching can promote consideration of career changes for industry personnel.
- Schools and industries can explore opportunities to build relationships beyond coteaching, such as career information, site visits for students, or summer job placements.

A-6 | Suggested Industry Volunteer Qualifications

1. Previous work with adolescents, either outside or inside of schools (e.g., tutoring, teaching, coaching)
2. Knowledge of prealgebra, algebra, and geometry
3. Undergraduate or graduate degree with concentration in mathematics, engineering, science, economics, or business
4. Positive feeling for adolescents
5. Comfort in setting limits
6. Flexible working style
7. Sense of humor and patience
8. Willingness to support teachers and schools

A-7 | Industry Volunteer Information Form

Name: _____

Name of company: _____

Work address: _____

_____

Work phone: _____

Home address: _____

_____

Home phone: _____

A-8 | Proposed Schedule for Industry Volunteers

Thursdays 9/15/91 – 6/4/92	Activity
September 5, 1991	Orientation (at EDC), 1:00 to 4:00 PM Meet co-teachers (social hour), 4:00 to 5:00 PM
September 19, 1991	Observe co-teachers in their classrooms, AM Follow-up (at EDC), 1:00 to 4:00 PM
September 26, 1991 October 3, 17, 24, 1991 November 7, 21, 1991 December 5, 19, 1991 January 9, 16, 30, 1992 February 13, 27, 1992 March 12, 26, 1992 April 9, 30, 1992 May 7, 21, 1992 June 4, 1992	Teaching in Schools (8:00 AM to noon, approximately)

A-9 | Interview Questions for Industry Volunteers

1. Could you please describe your job at _____?

2. What were your reasons for volunteering for this project?

3. Have you ever worked with adolescents before? in what capacity?

4. Some teachers will be interested in your describing to their students how you use math. Do you see ways of teaching students some of what you do, or of making up your own lessons concerning your job?

5. Would you prefer the middle or the high school level?

   Do you have a town preference?

   Do you have a preference for your industry volunteer coteacher?

6. Here is a hypothetical situation. Let's assume the classroom teacher has left a test with you to administer, and while the students are taking the test you notice the following: one student seems to be staring at the paper next to her or him, and you think the student might be cheating but you're not really sure. How would you handle this situation? What would you say or do?

7. Do you have any questions about this project?

8. Please fill out the information form, and note on the form any preference for grade level, town, or industry volunteer co-teacher.

A-10 | Acceptance Letter

To: **Returning Industry Volunteers**
From: **Faye Ruopp**
Re: **Participating in the Teachers, Time and Transformations Project, 1993 – 1994**
Date: **July 23, 1993**

Congratulations, once again! You have been selected to substitute for our returning group of teachers coming to EDC next year. I want to thank you formally for your continued interest; your support and enthusiasm are most appreciated.

This year, we again have the luxury of teaming you in the classroom with a partner. You will receive another letter at the end of August confirming our first gathering. We will not require your presence at the first formal orientation session on the afternoon of September 8, but we would like you to be at the social gathering from 4:00 to 5:00 that afternoon to meet your classroom coteachers. We would also like you to plan to observe your teacher the morning of September 15 so that he or she can walk you through the school's routines and introduce you to the kids. It would be most helpful if you could attend the second orientation session on the afternoon of the 15th (1:00 to 4:00 PM) so that you can establish a relationship with your fellow industry partner.

I have enclosed the seminar dates so that you can block them out on your calendars. If you have any questions, I will be back from vacation August 16 (617-969-7100 x2504, or you can reach Grace at x2505). Have a great summer — and thanks so much for your willingness to contribute to education and your communities. I look forward to seeing you in September!

Your site is _____.

A-11 | Notification Phone Scripts

Yes

Hello, this is _____ calling for Faye Ruopp and Grace Kelemanik at EDC. I am pleased to inform you that you have been selected to participate in the Teachers, Time, and Transformations Project to substitute for math teachers in the fall. You will be receiving a letter at the end of August reminding you of the first orientation session. Please be sure to block out the dates on the schedule you received for the seminar sessions. *[If the person needs another copy, offer to send one.]*

Your site is _____ *[see end of acceptance letter]*.

If you have any problems, questions, or concerns, Faye will be on vacation until August 16, but you can reach Grace at 969-7100 x2504. Congratulations — and we look forward to working with you!

No

Hello, this is _____ calling for Faye Ruopp and Grace Kelemanik at EDC. I am very sorry that we will not be able to offer you a position substituting for math teachers in our project at this time. We had a very large response this year and were unable to accept all who applied. We would, however, like to keep your name on a list of alternates, and if an opening presents itself, we will call you immediately. We certainly appreciate your willingness to participate. Thanks so much — and have a great summer! If you have any questions, please feel free to call Grace at 969-7100 x2505 or Faye at x2504.

A-12 | Memo on Introducing Industry Co-teachers in the Classroom

To: **Middle and High School Teacher Participants**
From: **Faye Ruopp**
Re: **Introduction of Industry Co-teachers in Your Classrooms**
Date: **September 10, 1992**

From our past experience, we have found that your introduction of the industry co-teachers to your students and your school has been extremely important in their success in the classroom. This memo is intended to give you a few suggestions for making their transition and future work in your classes as smooth and successful as possible.

On September 17, your industry co-teachers will be observing you in your classes. At this time, we suggest that you introduce them to your students as your co-teachers (the word *substitutes* has the usual negative connotations for kids, and therefore we try to avoid it). It should be clear to students that the co-teachers will be back twice each month, and will not only be teaching them mathematics, for which the co-teachers are highly qualified, but will also be sharing with students information on how mathematics and science are used in their jobs, information on careers in industry, and their firsthand knowledge of the work world.

As you can imagine, discipline issues for the industry co-teachers will be the most difficult hurdles to overcome. We hope that you make it clear to students that any disciplinary issues will be handled very seriously, not only by the industry co-teachers but also by you. (One of our middle school teachers last year, who was very effective, told his students that if he had any negative feedback from his industry co-teachers concerning any student, that student would be after school for one month with him. Needless to say, he had no problems!) The first two or three sessions are likely to be the most difficult, as students test their new teachers, but we hope you will support the co-teachers by doing the following:

1. Make clear to students your expectations about their behavior while the industry volunteers are teaching. Follow through on any consequences. (In the past, I've told students that I expect their behavior for outsiders to be substantially better than it is for me, since their behavior is a reflection of the school to the outside world.)
2. Introduce the industry co-teachers to the principal, housemaster, or any other person who will be dealing with serious problems. Please also introduce them to any colleagues who may be helpful, as well as your department chair, if applicable. The more people who are aware of the co-teachers' presence, the better the experience will be for them.
3. Tell your students why you are attending the seminars at EDC. Explain to them that the industry co-teachers are giving up valuable time of their own to help you out. These people are not getting paid to teach and are volunteering their time because they like kids, and they like to talk about their jobs.

We hope that you will bear with us during the transition period for the industry co-teachers; we would also appreciate your telling us what has worked for you in the past, and your sharing this information with other teachers in the project. Again, thanks for taking the time to make this part of the project work for all of us. We look forward to seeing you on September 24!

A-13 | Student Responsibilities and Math Class Procedures

Prepared by teacher Sheila Enright, Day Junior High School

1. You are to be in your seat, ready to work, at the start of class. "Ready to work" means that your notebook, homework, scientific calculator, textbook, and pencil or erasable pen are on your desk.
2. You are required to keep a separate notebook for math. The notebook should contain all notes and all homework from the textbook. Your notebook will be checked each term, and the grade will count as a quiz. Worksheets and handouts can be keep in a three-ring binder or a folder.
3. Homework is assigned every night. The homework will often involve reading a lesson, answering questions about the lesson, and working problems. Reviewing and preparing for tests and projects are other kinds of homework. Homework is due the day after it is assigned unless otherwise indicated.
4. If you do not complete a homework assignment, you must pick up a "Homework Excuse" form and fill it out, indicating when the assignment will be done.
5. If you are absent from class, you are responsible for all missed work. You must call the school in the morning to request homework or call a friend in the afternoon or make arrangements with me. Tests will be made up after school.
6. Lateness to class will not be tolerated. If you are late for class for a legitimate reason, you must have a pass. Students who are late without a pass will receive a detention.
7. Only one student at a time is permitted to leave the room and will do so with the permission of the teacher and a pass.
8. Gum and food are not allowed in the classroom.
9. Hats are not to be worn in the classroom.
10. The grades for each term are largely determined by the grades on quizzes and tests. If your score on a chapter test is low, you have five school days to restudy and retake the test. Homework, class participation, and effort are also important.
11. Extra work and help can only improve your understanding of the material and your grade. Extra credit assignments are provided regularly. I am available after school for extra help.
12. Hard work, cooperation, respect, and honesty are expected of all students at all times

If you choose not to follow these classroom expectations, the following will result:

First — warning
Second — cleaning up after school
Third — staying after school
Fourth — calling parent
Fifth — referring to office

Everyone's help is needed to make this a successful and enjoyable year.

B

Materials for Industry Volunteer Training Session 1

Descriptions and handouts for the specific activities from the first session of a typical EDC training workshop are reproduced here. The overall approach to volunteer training is discussed in Chapter 5 of the text.

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B-2 Introduce Program and Staff 49

B-3 Meet Your Industry Volunteer Colleagues 50

B-4 Goals and Objectives of the Orientation Sessions 50

B-5 The Great Divide 51

B-6 Employers' View Survey 52

B-7 Ideal Teacher Drawing 52

B-8 Videotape of an Industry Volunteer Teaching in the Classroom 53

B-9 Why Do Schools Exist? 53

B-10 Classroom Expectations as a Teaching Tool 54

B-11 Industry Volunteer Information Form 54

B-12 Homework 55

B-1 | Agenda for Industry Volunteer Training Session 1

Industry Volunteer Training Session 1 Agenda
(9:00 AM to noon)

1.	Introduce Program and Staff	(getting started)
2.	Meet Your Industry Volunteer Colleagues	(group activity)
3.	Goals and Objectives of the Orientation Sessions	(minilecture)
4.	The Great Divide	(individual and group work)
5.	Ideal Teacher Drawing	(group activity)
	BREAK	
6.	Videotape of an Industry Volunteer Teaching in the Classroom	(directed discussion)
7.	Why Do Schools Exist?	(group activity)
8.	Classroom Expectations as a Teaching Tool	(mini lecture)
9.	Industry Volunteer Information Form	(activity sheet)
10.	Homework	(observation guide)

Items on this agenda are described in the pages following this list.

B-2 | Introduce Program and Staff

Time: 10 minutes

1. Welcome
2. Introduce staff
3. Congratulations on being selected!

   You have been selected among your fellow employees as being particularly suited to dealing with large groups of children whose hormones have gone awry in small, confined spaces!

   More seriously — we want to express a heartfelt thank-you to all of you for offering your time, your knowledge, and your concern for the education of school students in Massachusetts.

   And if there is one element of your upcoming experience that we can highlight, it is risk-taking:
   - *on the part of students — learning new material*
   - *on the part of the teachers — leaving the classroom*
   - *on your part — venturing into the world of schools*

   I might add that this is a three-year endeavor. Although you have signed up for one year, we would like you to feel free to volunteer for next year as well — in fact, there are 18 people this year who are repeating their experience with us.

B-3 | Meet Your Industry Volunteer Colleagues

Time: 20 minutes

We thought we would begin by having you introduce yourselves according to the following format:

1. Take a minute to jot down on a piece of paper one word that describes why you wanted to become involved in this project. [Wait one minute.]
2. Come up to the front and write your word on one of the flip charts. [After the exercise, post the flip chart paper on the walls around the room.]

   Some words that have appeared on lists include *thankful, fulfilling, opportunity, future, curiosity, challenge, change, enrichment, learning, contribute, sharing, inspire, growth, contribution, trial, light bulb, improvement, children, enjoyment, love, give back, fun, interesting, kids, help, experimenting, influence, satisfaction, excited, intrigue, self-development, importance, adventure, discovery,* and *revitalize.*

3. Turn to your teaching partner — or the person sitting next to you if your teaching partner is not here [refer to list displayed in center of table] and introduce yourself, including what your job is and why you chose the word you wrote down. [Allow 15 minutes.]

   Note: We will be passing around a master list with your names and addresses — please initial and correct any mistakes. Also, during the social hour we will be providing forms for you to fill out to exchange information with your partners concerning phone numbers and the like.

B-4 | Goals and Objectives of the Orientation Sessions

1. To teach participants how to observe in the schools
2. To familiarize participants with typical school scheduling and use of time
3. To broaden participants' understanding of the role of the teacher and the demands of the teaching profession
4. To expose participants to a variety of models of learning and teaching; to develop a fuller understanding of the techniques available in the repertoires of skilled teachers
5. To help participants work in teams
6. To help participants understand the impact of teacher expectations on student performance
7. To develop participants' awareness of the rules, rituals, and routines of the school as a culture
8. To increase participants' understanding of the unique characteristics of elementary, middle, and high school students and programs
9. To develop participants' understanding of discipline and management techniques; to expose participants to methods for establishing and maintaining students' attention and motivation
10. To establish a support network for participants

B-5 | The Great Divide

Time: 30 minutes
Setup: Six to eight participants seated at round tables

Activity:

1. A new study shows a wide gap between what students and parents think of high school students' preparedness for jobs and college versus what their employers, college professors, and admissions officers think.
2. Pass out the Employers' View Survey. Have the industry volunteers fill out the survey individually. Tally the responses of the full group. Compare/contrast the results with those of the published study.

- Compare to employers' response.
- Contrast with student and parent response.
- Does this resonate with your experience?
- Would you feel comfortable talking to students about these issues?
- If you had one piece of advice, what would you say to the students?

Hand out copies of "The Great Divide" (*American Federation of Teachers*, Summer 1992, pages 33 – 35).

Level of Preparation Chart

	Employers		Students		Parents	
Recent high school graduates:	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Are able to work cooperatively with fellow employees	57	41	72	27	77	21
Can concentrate on work done over an extended period of time	30	66	73	27	65	25
Are capable of doing arithmetic functions	25	72	71	28	66	33
Have learned mathematics well	22	74	68	32	65	35
Have learned how to solve complex problems	10	86	57	43	48	52

Source: "An Assessment of American Education," Committee for Economic Development, Distribution Division, 477 Madison Avenue, New York, NY 10022 (212) 688-2063.

B-6 | Employers' View Survey

What is your perception of the level of preparation of recent high school students for the job market? Place a check mark in the column that indicates your perception of students' preparedness for each of the following attributes:

Recent high school graduates:	Prepared	Not Prepared
Are able to work cooperatively with fellow employees		
Can concentrate on work done over an extended period of time		
Are capable of doing arithmetic functions		
Have learned mathematics well		
Have learned how to solve complex problems		

Source: "An Assessment of American Education," Committee for Economic Development, Distribution Division, 477 Madison Avenue, New York, NY 10022 (212) 688-2063.

B-7 | Ideal Teacher Drawing

Time: 45 minutes
Setup: Six to eight participants seated at round tables

Activity:

1. Ask participants to do the following:
   - Take a minute to recall a teacher who has made a significant impression on you — good or bad!
   - Share some of those recollections and explain why the impression was good or bad.
   - Discuss, at your table, qualities of a good teacher. Make a list of those qualities. Then, turn those words into a drawing of the "ideal teacher." (Use the chart paper and markers on your table.)
2. Ask the participants at each table to show and explain their drawing.
3. Hang the drawings on the walls around the room.

B-8 | Videotape of an Industry Volunteer Teaching in the Classroom

Time: 15 minutes

1. Tell the participants the following:
   - We feel very fortunate that we were able to videotape one of our outstanding industry volunteers last year (she is with us this year as well!). She taught at Ottoson Junior High in Arlington, and we would like to show you part of her class to give you an idea of what a class might look like in which you share with students the mathematical applications in the work you do.
   - I will play about 10 minutes of the tape.
2. Ask participants to watch for the following:
   - What is the content?
   - What is the classroom environment like?
   - How does she handle individual students?
   - How does she handle potential discipline problems?
3. Lead a whole-group discussion. Solicit general reactions and then discuss responses to the elements participants were asked to watch for.

B-9 | Why Do Schools Exist?

Time: 15 minutes
Setup: Six to eight participants seated at round tables
Activity:

1. Hand out the participant worksheet.
2. Ask participants to answer, on their own, the question, "Why do schools exist?"
3. Have participants share their responses with others at their table. Then ask the participants at each table to work as a group to come up with general categories for their reasons.

   Some responses in the past have included the following:

   To teach basic academic and social skills

   To provide child care for the workforce

   To permit sharing of economic and academic resources

   To equalize opportunity

   To train a national workforce and produce active consumers

   To sustain and improve the society

   To shape a population capable of democratic action
4. Lead a whole-group discussion to share the small groups' categories.

B-10 | Classroom Expectations as a Teaching Tool

[Time: 15 minutes. This handout accompanies the minilecture on classroom expectations.]

Nothing influences behavior so strongly as the clear expectations of a significant other.

—*Jim Steffen, management consultant*

3 Key Messages

- This is important
- You can do it
- I Won't give up on you

4 Kinds of Expectations

- Quality and Quantity of Work
- Work Habits and Work Procedures
- Business and Housekeeping Routines
- Interpersonal Behavior

6 Qualities in Communicating Expectations

- Direct
- Specific
- Repeated
- Communicated with Positive Expectancy
- Modeled
- Struggled for with Tenacity

Source: Jon Saphier and Robert Gower, *The Skillful Teacher* (Carlisle, Massachusetts: Research for Better Teaching, Inc., 1987).

B-11 | Industry Volunteer Information Form

To the industry co-teacher: Please fill out *two* of these forms, *giving one to the classroom teacher you will be replacing, and the other one to your industry co-teacher:*

Your name: _____

Home address: _____

_____ Home phone: _____

Company name: _____

Company address: _____

_____ Company phone: _____

Best time to reach you: _____

B-12 | Homework

1. Record your classroom teacher's *Wednesday* morning schedule.

Time	Class
Period 1	
Period 2	
Period 3	
Period 4	
Period 5	

2. How has the classroom space been organized? Draw a diagram. Do students have assigned seats?

3. What is the organizational structure of the school?

   a. Who is in charge?
   b. To whom is your classroom teacher directly responsible?
   c. Is the school subdivided into smaller sections, houses, or departments? Describe.
   d. To whom will you go for support?

4. Meet the principal!

   a. What is her or his name?
   b. Where can he or she be found?

5. What does the teacher do about difficult discipline problems?

6. Record an interaction you observed in which some tension or conflict was evident. Think about what you believe the cause was and how the teacher handled it.

7. Record one instance when the teacher conveyed high expectations. In what way did he or she convey the expectations?

8. Did you observe any unusual rules or routines in your school? Please comment.

C

Materials for Industry Volunteer Training Session 2

Descriptions and handouts for the specific activities from the second session of a typical EDC training workshop are reproduced here. See Chapter 5 of the text for the overall approach to volunteer training.

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C-1 | Agenda for Industry Volunteer Training Session 2

Industry Volunteer Training Session 2 Agenda
(Noon to 5:00 P.M.)

1.	Debriefing after Classroom Visits	(open discussion)
2.	Cooperative Learning and Monty Hall	(group activity)
3.	Thinking about Discipline	(minilecture)
4.	Whaddayagonnado? Hypothetical Cases on Discipline Issues	(open discussion)
	BREAK	
5.	Meet Veteran Industry Volunteers	(open discussion)
6.	Working with a Partner	(partner discussions)
7.	Meet a Classroom Teacher	(minilecture/discussion)
8.	Questions to Be Answered and Support Networks	(activity sheet)

Items on this agenda are described in the pages following this list.

C-2 | Debriefing after Classroom Visits

Time: 30 minutes
Setup: Six to eight participants at round tables

Activity:

0. The Principal!
   - How many folks met the principal?
   - Portrait of a principal: First impression of the principal. Think of a word or phrase that you would use to describe the principal. Jot it down on the blank transparency at your table. Collect the transparencies and show them quickly on overhead.

     Sample portrait: brief, busy, accepting, informed, invisible, absent, visible, professional, enthusiastic, harried, welcoming, laid-back, friendly, short, easy-going, low-key, stern, new, well dressed
1. Dyad: "Talk about what stood out most for you during your school visit."
   - Pair up with someone other than your teaching partner.
   - For 1 minute, one person talks and the other listens. Talk about what stood out most for you during your school visit. Switch. The other person speaks now.

   In the whole group: Share a couple of those observations.
2. Rules and Routines
   - Put up a blank transparency to record rules and routines (food in classroom, wearing hats, bathroom, telephone calls, cutting class, etc.).

     Some routines and rules observed: Pledge of allegiance; Moment of quiet; No hats; Never leave class; No beepers; No gum; No dress code
   - Whole-group discussion: "What rules and routines did you observe?"
3. Discipline
   - Whole-group discussion: "Did you observe any instances of a discipline problem?"

C-3 | Cooperative Learning and Monty Hall

Time: 45 minutes
Setup: Six to eight participants seated at round tables

Activity:

1. Present the basics of cooperative learning:
   - There are three classroom environments: competitive, individual, and cooperative. [Explain all three.]
   - There is more to cooperative learning than group work. [Go over handout.]
2. Conduct a cooperative learning exercise. Assign roles — facilitator, recorder, checker, cheer leader. Have participants use cups and a penny to play the game below, 10 times switching and 10 times not switching. Ask what conjectures the results lead them to make.

   Let's Make a Deal Game

   Suppose that you are on a TV game show and the host offers you a choice of three doors. Behind one door is a valuable prize; behind each of the others is a goat.

   You pick one door (say, door 2).

   The host, who knows what is behind each door, then opens one of the other doors to reveal a goat.

   The host now gives you a choice: Do you want to stay with the door you've picked or switch to the remaining unopened door?

   Is it to your advantage to switch? Explain.

   Answer: You should switch. Your probability of winning if you do not switch is one in three. But your probability of winning if you do switch is two in three.

C-4 | Cooperative Learning Models Handout

Essential Attributes

1. Group interdependence
   - Shared goals — signing off
   - Resource interdependence
   - Group rewards
2. Face-to-face interaction
   - Students are required to discuss the material
3. Individual accountability
   - Quiz
   - Numbered heads
   - Individual products
4. Social skills training
   - Using names
   - Encouraging
   - Checking for understanding
   - Checking for agreement
   - Sharing ideas and information
   - Group processing
5. Heterogeneous groups
   - High/average/low performers
   - Racial or ethnic identity
   - Male/female
   - Outgoing/shy

C-5 | Thinking about Discipline — Handout 1

Important Instructional Tactics to Help Manage a Classroom

- Spend time planning appropriate lessons and backup activities.
- Set groundrules so that expectations and boundaries are known.
- Keep the whole class involved so that students do not become distracted or have time to misbehave.
- Provide for students with different ability levels so everyone has meaningful work to complete.
- Monitor the progress of all your students and adjust lessons as needed.
- Model appropriate behavior to help students learn what is expected and appropriate.

Handling Minor Behavior Problems

- Use signaling techniques to head off disruptive behaviors.
- Use "I-messages" to communicate your thoughts or feelings that result from the behavior.
- Use physical proximity to help decrease inappropriate behavior.
- Use humor (but avoid sarcasm) to draw attention to potential behavior problems.
- Use reality appraisal (a statement describing the actual problem situation) to create awareness among the students and help them realize the possible consequences of inappropriate behavior.
- Implement peer monitoring (buddy system or cooperative learning projects) to minimize problems with a particular student.

C-6 | Thinking about Discipline — Handout 2

Preventing Behavior Problems

- Begin implementing classroom management strategies from day 1.
- Provide a physically safe and supportive classroom environment.
- Design learning activities that will be meaningful to your students and compatible with their interests and abilities.
- Provide opportunities for all students to experience success.
- Give specific directions and feedback.
- Encourage students to make decisions and accept responsibility for their work.
- Openly acknowledge when students are behaving well.
- Avoid punishment if at all possible.

C-7 Thinking about Discipline — Handout 3

Prepared by Jerome J. Schultz, Ph.D.

(This handout accompanies a mini-lecture on various approaches to classroom discipline — 20 minutes.)

Some BIG NAMES in Classroom Management

WILLIAM GLASSER (Reality Therapy)

1. Concentrate on present behaviors; do not dwell on previous ones.
2. Establish and enforce reasonable rules.
3. Accept all students as being potentially capable.
4. Point out to your students how learning in school relates to their experiences outside school.
5. Do not punish students.
6. Hold class meetings to discuss classroom and real-world events that are important to students.

JACOB KOUNIN

1. Demonstrate "withitness" to help maintain control.
2. Handle overlapping situations with ease to facilitate management.
3. Maintain momentum to minimize behavior problems.
4. Keep the whole class involved to prevent boredom.
5. Provide variety in the classroom to facilitate good behavior.
6. Be aware of the "ripple effect."

B. F. SKINNER

Technique: "Behavior Modification"
Theory: All behavior is learned. Behavior is affected by what happens after it (what reinforces it.)
Terms/concepts: reinforces
extinction
the Premark principle

THOMAS GORDON

Technique: "Teacher Effectiveness Training" (TET)
Theory: Effective management depends on good communication.
Terms/concepts: Who owns the problem?
"I-messages"
"The Dirty Dozen": roadblocks to communication

RUDOLPH DREIKURS, M.D.

Technique: "Logical Consequences"
Theory: Children misbehave to achieve certain goals.
Attention
Power
Revenge
Helplessness

C-8 | Thinking about Discipline — Handout 4

Prepared by Jerome J. Schultz, Ph.D.

Whaddayagonnado?
Hypothetical Cases on Discipline Issues

- A student walks into class, slams his books down on his desk, and (referring to the Vice principal/ disciplinarian) yells: "THAT GUY'S AN #*!!$#!!"
- A sixth-grade girl sits in the back of class, slumped over her desk, appearing disheveled. You ask the students to get out their books and turn to a certain page. The young woman remains "aggressively passive" and does not move.
- Just before class two kids come into the room in the midst of a heated argument. Their faces are flushed, and it appears that they have been in a fight. The other kids sense this and move away. Just before the two students sit down, one throws a punch at the other, knocking the student to the floor.
- In the middle of a multiple small group (cooperative learning) activity, one of the students asks to go to the bathroom. You say "sure" and she goes. Within five minutes, another asks to get permission. Then two more raise their hands. Students #1 and #2 have not yet returned.
- During a quiet seatwork activity, a student chews gum (or something) rather audibly. You ask him to stop. He looks at you, smiles at you and at the other kids around him, and continues chewing.
- You find out that the students have switched seats on you, and are "playing games" with you. They all get the joke, *but think you don't.*

C-9 | Questions to Be Answered and Support Networks

Time: 20 minutes

Activity:

0. Dyad: "I Am Anxious/Worried About..."

Pair up with your industry volunteer coteacher. For two minutes, have one person speak while the other only listens. Finish this sentence: "I am anxious/worried about..." After two minutes, switch; listeners speak, and speakers listen.

1. Questions to Be Answered

You and your co-teacher will now discuss ways in which you can support each other while you are in the classroom. We have written up some questions that you need to be clear on before you leave. Take 10 minutes with your partner, keeping in mind the anxieties, uncertainties, fears you just talked about when you are answering the questions. Add others to the list that directly respond to some of those anxieties.

Sit down with your co-teacher and answer the four questions on the "Questions to Be Answered Worksheet."

Are there any other questions that need to be answered for you?

2. Support Networks

Whole-group discussion: Do you have suggestions for ways in which this "group" can provide support to each of you individually?

C-10 | Questions to Be Answered Worksheet

1. Who will be contacting your classroom teacher before the first seminar day on September 24?

2. Who will be contacting your classroom teacher before each of the other seminar days? Will it be the same person or the person doing most of the teaching that day?

3. How will you handle team teaching? What are different models of working together in a class?

4. To whom will you go in school if you need help?

D

Sample Industry Lessons

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D-8 The Infamous Peanut Butter and Jelly Experiment (a computer programming problem) 86

D-1 Code Breakers

Prepared by Jonathan Worthley and Karen Dunn
of Digital Equipment Corporation

We introduce two techniques for generating codes. The first is the offset method and the second is the reverse alphabet. Since the latter is the simplest to explain, we start with that first. It consists of reversing the alphabet and numbers, if numbers are used in the message. Table 1 shows how this is done.

Table 1. The Reverse Alphabet Code

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
Z Y X W V U T S R Q P O N M L K J I H G F E D C B A
0 1 2 3 4 5 6 7 8 9
9 8 7 6 5 4 3 2 1 0

As an example, the code for the word HELLO would be SVOOL.

An offset code of +2, for example, would encode HELLO into JGNNQ. That is, we replace H with the letter 2 places ahead of H in the alphabet, J, E with G, and so on. To decode it, just move 2 letters back.

To detect a reverse alphabet code, it is best to just try it first on every line of code. If it is the correct guess, intelligible words start to show up right away.

The offset codes are tougher to crack. We recommend counting to see which letter (or letters) appears most often in a line of code and then replacing it with one of the more frequently used letters in the English language. To make it easier, all offsets are 5 or less. Knowledge of where vowels and frequently used consonants appear in words is used to "guess" the offset. By substituting the guess for a frequently repeating letter, the students can use that offset to decode the letters near their guess. If words start to emerge, the code is broken. It usually takes only a few decoded letters to determine if the guess was correct.

This exercise works well in teams, because each student can work on a different line or the team members can divvy up the attacks on a particular line and crack it faster. The team approach also fosters competition. A prize was offered to the team that cracked all the codes first.

NAME _____ **CLASS** _____

PROBLEM: CHOCOLATE

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
Z Y X W V U T S R Q P O N M L K J I H G F E D C B A

0 1 2 3 4 5 6 7 8 9
9 8 7 6 5 4 3 2 1 0

1. AQW ECPPQV UCA VJCV COGTKECPU FQ PQV
2. FYTC RFCGP NPGMPGRGCQ QRPYGEFR.
3. MBTU ZFBS UIFZ TQFOU GPVS CJMMJPO EPMMBST
4. LMXSL XLOZG VDSRX SRHZY RGNLI V
5. YMFSBYMJBFRTZSYBXUJSYBTSBUJWXTSFQ
6. ZLJMRQBO EXOATXOB XKA PLCQTXOB MRO QLDBQEBO.

ANSWERS: You cannot say that Americans do not have their priorities straight. Last year they spent four billion dollars on chocolate, which is a bit more than the amount spent on personal computer hardware and software put together.

1. offset +2
   YOU CANNOT SAY THAT AMERICANS DO NOT
   AQW ECPPQV UCA VJCV COGTKECPU FQ PQV
2. offset -2
   HAVE THEIR PRIORITIES STRAIGHT.
   FYTC RFCGP NPGMPGRGCQ QRPYGEFR.
3. offset +1
   LAST YEAR THEY SPENT FOUR BILLION DOLLARS
   MBTU ZFBS UIFZ TQFOU GPVS CJMMJPO EPMMBST
4. reverse alphabet, blocks of 5
   ON CHOCOLATE, WHICH IS A BIT MORE
   LM XSLXLOZGV, DSRXS RH Z YRG NLIV
   LMXSL XLOZG VDSRX SRHZY RGNLI V
5. offset +5, space = B
   THAN THE AMOUNT SPENT ON PERSONAL
   YMFSBYMJBFRTZSYBXUJS‹BTSBUJWXTSFQ
6. offset -3
   COMPUTER HARDWARE AND SOFTWARE PUT TOGETHER.
   ZLJMRQBO EXOATXOB XKA PLCQTXOB MRO QLDBQEBO.

D-2 Logic Gates Lesson

Prepared by Judy Weiss Prescott and Andrew Stewart of Digital Equipment Corporation

We presented the sixth grade class with the basic building blocks in computer design. These are called logic gates. The two most basic gates are the AND gate and the OR gate. We passed out a sheet with these gates on them and with some of the logic tables partially drawn on the sheet as an example. Now the goal during class was to understand the concepts of these gates and to be able to fill in the logic tables for each of the gates.

We asked for volunteers to help us. First we started with the AND gate. An explanation that a "1" indicated ON and a "0" indicated OFF followed. As a class, we decided that the lights were a good indication as ON and OFF, so we used these as our OUTPUT.

The first volunteer put a hand on the light switch. The other two were the INPUTS. When the INPUTS raised their arm and touched the OUTPUT (thus making a connection), this was considered a "1." When the hand of the INPUT was down by his or her side (not making a connection), this was considered a "0." For the AND gate, *both* INPUTS had to make a connection for the light to go ON. We played with different variations of this until students got the idea. Then we had the class fill in the logic table for an AND gate.

Then we got three more volunteers. We still had 2 INPUTS and 1 OUTPUT. The rules were the same for 1 and 0, but the logic gate changed to an OR gate. This time the light was allowed to be turned ON (a "1") whenever *either* (or *both*) of the INPUTS made a connection. We played with this combination for a bit and then drew and filled in the logic table for the OR gate.

The XOR2 gate is an exclusive OR gate. This gate works very much like the OR gate except it does *not* go on if *both* INPUTS make a connection. We used the volunteers again to make this point.

By involving the students, they quickly caught on to the concepts of the simple logic gates. They were also very enthused by the outcome of their actions. Everyone wanted to be a volunteer (any reason to get out of your seat, right?).

We then had them attempt the 3-input AND gate and the 3-input OR gate. These were tricky for some and easy for others. After we talked about these for a few moments, we then turned to the back of the sheet.

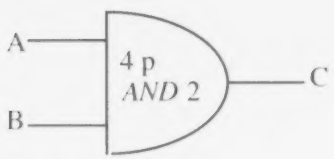
We attempted (as a class) to draw the circuit for the food problem on the bac[1] They needed some guidance but came up with the correct circuit. Then we took some volunteers, one for each role in the problem, and acted it out. As a class, we determined when we got to have spaghetti.

Time quickly ran out in the class. We only got as far as going through a few possibilities and their outcomes. The next logical step would be to generate a table for this problem with the INPUTS and the OUTPUTS.

We have included four sample logic gates and a worksheet with answers for this logic gate lesson.

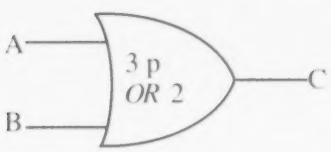
Logic Gates answers:

Four Sample Logic Gates



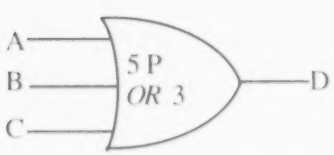
AND gate

Input		Output
A	B	C
0	0	0
0	1	0
1	0	0
1	1	1



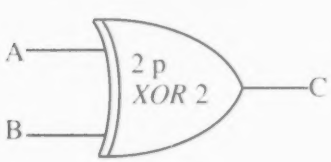
OR gate

Input		Output
A	B	C
0	0	0
0	1	1
1	0	1
1	1	1



OR gate

Input			Output
A	B	C	D
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

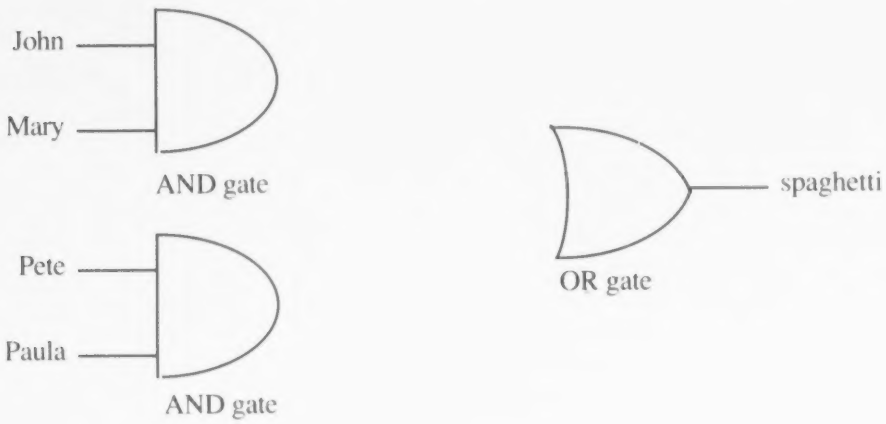


XOR2 gate

Input		Output
A	B	C
0	0	0
0	1	1
1	0	1
1	1	0

Circuit Diagram and Logic Table for the Food Problem:

If (John and Mary) or (Pete and Paula) come to dinner, then we will have spaghetti.



John	Mary	Pete	Paula	spaghetti
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

D-3 Statistics from Class Data

Prepared by Jon Mysel of Digital Equipment Corporation

In the first class that Mark and I did on our own, we each spent a few minutes introducing ourselves and then asked the students to fill out a 3x5 index card with the following information, so we could learn more about them:

__Name __Year __Subjects you like __Subjects you dislike __Outside interests

We decided that rather than just reading the cards, we would enter the information into a database and run some general descriptive statistics to review with the class. I presented the data to the class starting with the raw data in the form of a spreadsheet and explained how you "code" data into a database. Then I reviewed the output for all of the classes (likes, dislikes, outside interests) in the form of a frequency table and explained each of the columns (value, frequency, percent, etc.) Then I showed the *same* data using a bar chart to illustrate that it is a much easier way to represent and interpret the data. Then I showed them the same data, but for their class *only* (we have four different classes.)

The next step was to show students how the data could be used to draw "generalized" conclusions to describe the population. I asked them to "predict" the disliked subjects for those students who reported that they liked math (before actually showing the data.) Most were able to guess that they would tend to dislike English or languages. I showed the data (only students who liked math) and explained that the proper way to generalize the data would be to say, "Those students who like math *would tend to* dislike English and languages." I explained that from descriptive data like this, you can't draw significant conclusions of the form, "Students who like math dislike English and language."

Next we handed out samples of the data cut different ways:

- All classes, students who like science
- All classes, students who dislike English
- All classes, students who have outside interests that include art
- And so on

We had the students break into groups and develop three or four generalizations of the data in the general form, "Students who like XXX tend to dislike YYY."

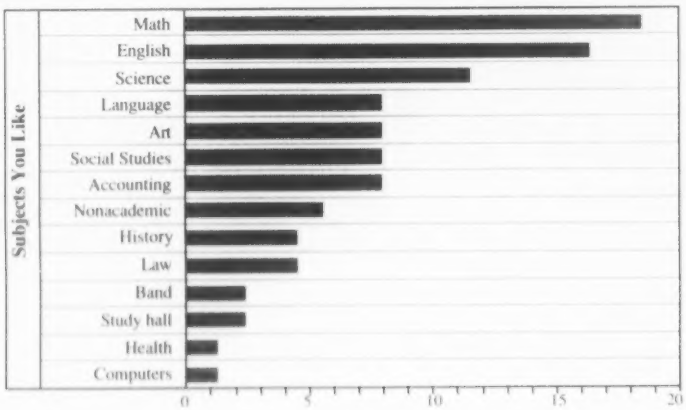
We shared the results, and I wrapped up by explaining that by taking half an hour to enter the data into a database and running it through simple statistical analysis, it is very easy (and effortless) to access this kind of information. Finally, I reviewed the transformation of the data from cards to database to output.

Subjects you like

All Classes (all choices)

Value Label	Value	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Math	5	16	14.8	18.4	18.4
English	2	14	13.0	16.1	34.5
Science	6	10	9.3	11.5	46.0
Language	1	7	6.5	8.0	54.1
Art	4	7	6.5	8.0	62.1
Social studies	7	7	6.5	8.0	70.1
Accounting	12	7	6.5	8.0	78.2
Nonacademic	15	5	4.6	5.7	83.9
History	3	4	3.7	4.6	88.5
Law	10	4	3.7	4.6	93.1
Band	9	2	1.9	2.3	95.4
Study hall	11	2	1.9	2.3	97.7
Health	8	1	.9	1.1	98.9
Computers	13	1	.9	1.1	100.0
	.	21	19.4	missing	
	Total	108	100.0	100.0	

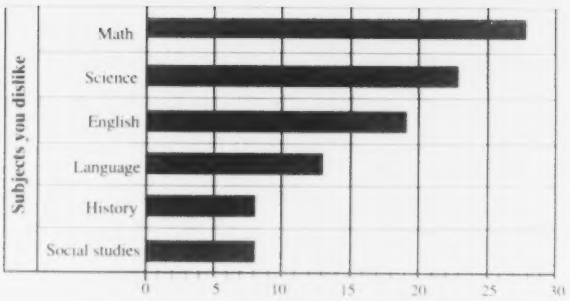
Valid cases 87 *Missing cases 21*



Subjects you dislike

All Classes (all choices)

Value Label	Value	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Math	5	19	17.6	27.9	27.9
Science	6	15	13.9	22.1	50.0
English	2	13	12.0	19.1	69.1
Language	1	9	8.3	13.2	82.4
History	3	6	5.6	8.8	91.2
Social studies	7	6	5.6	8.8	100.0
	.	40	37.0	missing	
	Total	108	100.0	100.0	

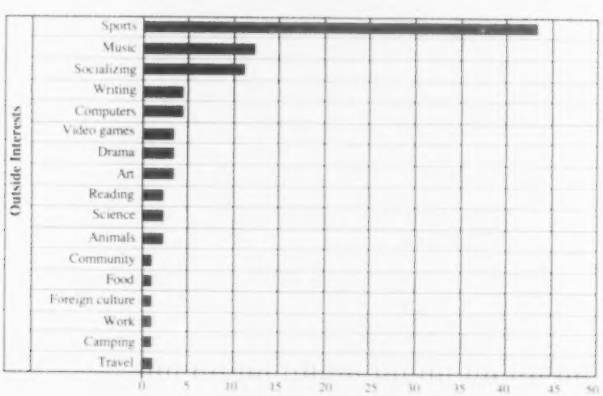


Outside Interest

All Classes (all choices)

Value Label	Value	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Sports	1	39	36.1	43.8	43.8
Music	4	11	10.2	12.4	56.2
Socializing	9	10	9.3	11.2	67.4
Writing	6	4	3.7	4.5	71.9
Computers	8	4	3.7	4.5	76.4
Video games	2	3	2.8	3.4	79.8
Drama	3	3	2.8	3.4	83.1
Art	10	3	2.8	3.4	86.5
Reading	5	2	1.9	2.2	88.8
Science	12	2	1.9	2.2	91.0
Animals	15	2	1.9	2.2	93.3
Community	7	1	.9	1.1	94.4
Food	11	1	.9	1.1	95.5
Foreign culture	13	1	.9	1.1	96.6
Work	14	1	.9	1.1	97.8
Camping	16	1	.9	1.1	98.9
Travel	17	1	.9	1.1	100.0
	.	19	17.6	missing	
	Total	108	100.0	100.0	

Valid cases 89 Missing cases 19



D-4 Number Systems: Translation from the Decimal to the Binary System

Note: Lessons D-4 and D-5 were developed as a part of a semester-long series by Kathleen McGovern and Trushar Patel of NYNEX with the help of their classroom teacher, Eileen Heneberry. Their semester schedule is reproduced at the end of lesson D-5.

This project was designed to familiarize the students with the concept of numerical systems. A comparison was made between verbal and mathematical "languages" in order to present the concept that understanding a second language is done by translating from the second language to the one we are comfortable with, and that is as true of mathematical systems as it is of verbal languages. While we ordinarily think in terms of our first language, we broaden our scope of understanding representational systems when we encounter a second system, or another way of organizing and representing things.

We initially went over the advantage that mathematical translations have over verbal translations. With verbal translations, you must either memorize or look up the translations, in addition to understanding the rules of grammar. However, with mathematical translations, you only have to understand the mathematical relationship of, for example, the binary system to the "native " decimal system in order to be able to translate from one to the other. Understanding this relationship tends to reinforce concepts of "place value: and exponential value" in the decimal system.

We also spent some time discussing how different numbering systems come about, why we use a base 10 system (most likely because we have 10 fingers), and why computers and digital telecommunications use a base two system (because of the on and off states of electrical current — we turned the light switch on and off to illustrate this). We then pointed out some properties of these number systems, such as that the number of symbols used is the same as the base (0 – 9, or ten symbols for decimal, and 0 – 1, or 2 symbols for binary), with all the other numbers being created with combinations of these symbols combined with the concept of "place value."

After the explanation of the method of translation from binary to decimal was completed, the class went to the board to translate numbers from binary to decimal as well as decimal to binary. Although this lesson was designed for just one class, it probably should be expanded to cover several classes and made into a game to make it more interesting to the students.

Number Systems Handout:

We use a BASE 10, or DECIMAL, number system, but this is only one of many possible number systems that can be used. Computers and digital telecommunications use a BASE 2, or BINARY, number system. You can translate from one system to another just like you do from one language to another, such as translating from English to French. (For example, HAT in English = CHAPEAU in French.)

These are the translations from DECIMAL to BINARY for the numbers 0 through 32:

DECIMAL		BINARY	DECIMAL		BINARY
0	=	0000 0000	16	=	0001 0000
1	=	0000 0001	17	=	0001 0001
2	=	0000 0010	18	=	0001 0010
3	=	0000 0011	19	=	0001 0011
4	=	0000 0100	20	=	0001 0100
5	=	0000 0101	21	=	0001 0101
6	=	0000 0110	22	=	0001 0110
7	=	0000 0111	23	=	0001 0111
8	=	0000 1000	24	=	0001 1000
9	=	0000 1001	25	=	0001 1001
10	=	0000 1010	26	=	0001 1010
11	=	0000 1011	27	=	0001 1011
12	=	0000 1100	28	=	0001 1100
13	=	0000 1101	29	=	0001 1101
14	=	0000 1110	30	=	0001 1110
15	=	0000 1111	31	=	0001 1111
			32	=	0010 0000

In the DECIMAL system, $10^4 = 1000$, $10^2 = 100$, $10^1 = 1$, $10^0 = 1$.
In the DECIMAL system, $2 \times 10^3 = 2000$, $2 \times 10^2 = 200$, $2 \times 10^1 = 20$, $2 \times 10^0 = 2$.

The DECIMAL number 999, when expressed in positional powers of the base, is
$(9 \times 10^2) + (9 \times 10^1) + (9 \times 10^0) = 900 + 90 + 9 = 999$.

The DECIMAL number 1000, when expressed in positional powers of the base, is
$(1 \times 10^3) + (0 \times 10^2) + (0 \times 10^1) + (0 \times 10^0) = 1000 + 0 + 0 + 0 = 1000$.

In the BINARY system, the BINARY number 1000, when expressed in positional powers of the base, is
$(1 \times 2^3) + (0 \times 2^2) + (0 \times 2^1) + (0 \times 2^0) = 1000 + 0 + 0 + 0 = 1000$ (= 8 DECIMAL).

D-5 | City Planning Math Project

Note: Lessons D-4 and D-5 were developed as a part of a semester long series by Kathleen McGovern and Trushar Patel of NYNEX with the help of their classroom teacher, Eileen Heneberry. Their semester schedule is reproduced at the end of this lesson.

My teaching partner and I are currently involved in the third session of a project that uses an urban planning software simulation to teach math. Because the computers in the middle school were confined to a computer lab for teaching computers as a separate subject, we realized we would have to use corporate resources in order to integrate computer software into the math curriculum. I requested the use of our district's color portable PC and a portable PC projector for two mornings a month and worked on a math project using an educational software package called SimCity by Maxis Software that simulates the growth and management of a city budget, complete with an animated full-color scale model of a city and its subsystems.

We worked together to develop a complex math problem-solving project that is now underway and that will take approximately six class sessions for each math class to complete. The students are designing and building a city, using a cooperative learning model, that integrates complex budget estimating involving rations, percentages, mathematical formulas, and basic math with principles of city planning and the management of town and city government. Our classroom teacher has supplemented our city planning using figures from the local town budget, which relates our City Planning Math Project to the budgetary realities of the students' hometown. We are also exploring the idea of integrating NYNEX's Choices Program (for which I am also a volunteer) into the project in order to demonstrate the relationship of personal budgetary management to town budget management — allowing students to experience both sides of the taxation equation.

Thus far, we have implemented the City Planning Math Project by dividing the city to be planned into four quadrants, or neighborhoods, and allocating a budget of $64 million to each of the four groups who are planning a section of the city. (Since the smallest amount of funds they use is $1,000, we decided to temporarily exclude the last three zeros.) Each group of students got to name their own section of the city, vote with the class on the name of the whole city, select two professions (which will be used in a later session), vote on the tax rate, and allocate their tax budget. To make it easier to understand the allocation process, we broke the funding amounts into zoning, city service, infrastructure, and shared funding sections (see handout.) In the initial budget planning, we are allowing two or three planning sessions to allow students to get comfortable with the best zoning ratios for optimal growth; the formulas for relating infrastructure and city services to total number of residential, commercial, and industrial zones; and the optimal percentage rates for taxation. Several attempts (and lots of erasing) were necessary for the students to get a feel for the budget allocation process, but so far they seem to be enjoying the process, work well together in their groups, and are looking forward to designing the layout of the city. This week, we plan to finalize the budgets by negotiating between the four groups for funding allocations for the sports stadium, seaport, and airport. (So far, all the students want to build the stadium in their section of the city.)

We plan to add additional handouts for the city management section of the project, and we will do an evaluation of the project at the end with the students and the classroom teacher. We will submit that material to you in June.

The final class in June will consist of a presentation on future careers in technology, in which we will link the future of telecommunications (our company) with the future of computing (my field) and the media. Drawing on video clips and computer demo's from a variety of university research labs and high-tech corporations, an exciting view of future careers in a variety of professions utilizing multimedia computing and telecommunications will be presented to the students, which we hope will encourage them to get the education necessary to take advantage of the many wonderful career opportunities in the technologies of the future.

Note: Lessons D-4 and D-5 were developed as a part of a semester long series by Kathleen McGovern and Trushar Patel of NYNEX with the help of their classroom teacher, Eileen Heneberry. Their semester schedule of eight sessions is reproduced here.

Session 1 — Number systems: Conversion from Decimal to Binary Systems

The mathematics of computing and digital telecommunications.

Session 2 — Integrating Computers and Urban Simulation Software into the Curriculum

Overview of SimCity software with an outline of the City Planning Math Project.

Session 3 — City Planning Math Project

Urban budget estimation divided into four categories: zoning, city service, infrastructure, and shared costs.

Session 4 — City Planning Math Project

Finalization of city quadrant budgets with negotiation of shared costs for whole city; initial layout of city on paper; familiarization with software for building city; entry of budget data and layout into system.

Session 5 — City Planning Math Project

Completion of city layout on paper and entry of layout data into system.

Session 6 — City Planning Math Project

Outcome of initial simulation; discussion and suggestions for budget alterations, tax changes, structural changes, etc., to urban systems.

Session 7 — City Planning Math Project

Outcome of final simulation; discussion and evaluation by the class. Choices project, relating personal budgets to town budget.

Session 8 — Future Careers in Technology: Merging of Computers, Telecommunications, Media

Presentation of videotapes and software demos illustrating the way technology will alter the careers of the future.

Handout for City Planning Lesson

My name _____ My job (1) _____ (2) _____

Our city's name _____ Our section of the city _____

Annual Budget

Cost per section (in thousands)		*Annual Maintenance Costs:*
Bulldozing	$1	
Power Line on Land	5	
Power Line on Water	25	
Road Building	10	$1
Bridge Section	50	4
Railroad Section	20	4
Railroad Tunnel	100	10
Park	10	
Residential Zone	100	
Commercial Zone	100	
Industrial Zone	100	
Police Department	500	100
Fire Department	500	100
Coal Power Plant	3,000	
Nuclear Plant	5,000	
Sports Stadium	3,000	
Seaport	5,000	
Airport	10,000	

Ratios: 2 residential zones per 1 commercial and 1 industrial zone
1 coal power plant per 50 zones
1 nuclear plant per 150 zones
2 road/rail sections per zone (residential, commercial, or industrial)

Taxes: Tax rates are a percentage of the earnings of each citizen of the city.

The maximum rate is 20 per cent and the minimum is 0 per cent.

The best tax rate for fast growth is between 5 and 7 per cent.

The tax collection formula is:

Tax = (population) x (land value) x (tax rate) x (a scaling constant).

Cash flow = taxes collected – total allocated funds.

Our tax rate is _____ .

Our section has a population of _____ .

City Planning Budget Form

Annual budget for city section		$_____	
Total residential zones	_____	total cost	$_____
Total commercial zones	_____	total cost	$_____
Total industrial zones	_____	total cost	$_____
Total park zones	_____	total cost	$_____
		Zoning Subtotal	$_____
Total coal power plants	_____	total cost	$_____
Total nuclear plants	_____	total cost	$_____
Total police departments	_____	total cost	$_____
Total fire departments	_____	total cost	$_____
Annual police and fire maintenance	_____	total cost	$_____
		City Service Subtotal	$_____
Total road sections	_____	total cost	$_____
Annual Maintenance			$_____
Total rail sections	_____	total cost	$_____
Annual Maintenance			$_____
Total land power lines	_____	total cost	$_____
Annual Maintenance			$_____
		Infrastructure Subtotal	$_____
Our share of stadium	$_____	Zoning Subtotal	$_____
Our share of seaport	$_____	Service Subtotal	$_____
Our share of airport	$_____	Infrastructure	$_____
Shared facilities subtotal	$_____	Shared Facilities	$_____

City Section TOTAL BUDGET $ _____

D-6 Party Budgets

Prepared by Judy Weiss Prescott and Andrew Stewart of Digital Equipment Corporation

Budgets are part of every workforce and everyday life. We are going to work out a budget here in class. As a class (before the actual meeting is held), we must determine the following:

Purpose of the budget _____

Allotted money per student $_____

Working budget $_____

For our purposes, we will hold budget meetings consisting of 3 board members. At each board meeting, work out your group's budget. On the budget sheet, write down the items in the estimated cost column and work out a budget estimate first. Then work out actual costs and add them up. Make sure you do not go over your allotted funds.

The object is to get the most for your money and spend the money on what you think is important. Refer to the shopping list for exact prices of items. This is the only place you are allowed to shop.

Team name Members

Calculate how many drinks each student gets. _____

How many ounces of drink does each student get? _____

Calculate how much food each student gets. (Popcorn, chips, cake, etc.)

What else is needed for a successful party?

Party Budgets Handout

Team name _____

BUDGET PLAN		ACTUAL BUDGET	
Item	Estimated cost	Item	Actual cost
TOTAL ESTIMATED BUDGET		TOTAL ACTUAL BUDGET	

Shopping List Handout:

	Quantity	Cost
Paper goods		
Funpak napkins	120	2/$1.00
Blue napkins	250	1.39
Plastic cups (9 oz.)	36	.99
Generic cups (9 oz.)	80	1.19
Paper plates (9 in.)	100	.99
Generic paper cups (7 oz.)	100	1.19
Big plastic cups (16 oz.)	20	1.49
Dixie paper cups (3 oz.)	100	.99
Paper plates (7 in.)	48	1.99
Beverages		
Hawaiian punch (fruit juice)	128 oz.	1.99
Grape Kool-Aid (for 2 qts.)	.5 oz.	.79
Berry Kool-Aid (for 8 qts.)	19 oz.	2.49
Coke	16 oz.	2/.89
Coke (in 12 oz. cans)	12	2.99
Pepsi in bottles	67.6 oz.	.99
Coke in bottles	67.6 oz.	.99
Generic cola (in 12 oz. cans)	24	3.99
Spring water	1 gal.	.89
Candy		
Chocolate mints (Brach)	30	2.19
Peppermint patties	14 oz. (~ 25)	2.39
Kit Kat	10	.99
Nestle Crunch bars	15 oz.	1.99
Popcorn (unpopped)		
Bagged Jiffy popcorn	3 lbs.	2.19
Generic popcorn	64 oz.	.99
Redenbacher popcorn	15 oz.	1.49
Popcorn (popped)		
Boston Lite popcorn	7 oz.	1.89
Chips		
Chipitos (tortilla chips)	10.5 oz.	1.99
Eagle potato chips	14.5 oz.	2/3.00
Generic tortilla chips	12 oz.	.99
Cheese twists	12 oz.	2/3.00
Cape Cod potato chips	11 oz.	1.99
Cookies/Cakes		
Cupcakes	6	2.49
Variety snack pack (~.5 oz.)	12	2.29
Oreos	16 oz. (~39)	1.99
Grasshoppers (choc. mint)	10 oz. (~40)	2/3.00
Fudge sticks	9 oz. (~28)	1.49
8 inch cake	serves 8 – 12	9.99
1/4 sheet cake	serves 12 – 18	11.99
1/2 sheet cake	serves 15 – 32	17.99
Cake mix for 8-in. cake		1.49
Frosting mix for 8-in. cake		1.29

D-7 Calculating Electrical Current for a Circuit (a division problem)

Prepared by Andrew Stewart of Digital Equipment Corporation

The sixth-grade math class was doing a lot of division problems. I wanted to show the class that division was used in my job at Digital Equipment Corporation.

As a hardware design engineer, one of our "favorite" formulas is called Ohm's Law, which says that the voltage in a circuit is equal to the current multiplied by any resistance in the circuit.

$$v = i\,r$$

where v = voltage in volts
i = current in amps
r = resistance in ohms

I made up a worksheet (enclosed) of a few problems with circuits containing batteries and resistors. Given the battery voltage (v) and the resistor value in ohms (r), one calculates the current (i) thus:

$$i = v / r$$

The symbols on the worksheet took some explaining before the students understood what it all meant. I equated the problem to things with which they are already familiar, such as D-cell flashlight batteries and light bulb filaments. We got into a discussion of exactly how a flashlight works, from which I drew a circuit schematic of a flashlight. Given that, the students were much more ready to understand the somewhat abstract pictures of circuits on the worksheet.

The division problems were fairly simple, once you got right down to it, but the students were somewhat intimidated by the symbols and the new terms *volts*, *amps*, and *ohms*. In retrospect, this would have worked better if I had actually constructed a circuit with real batteries and resistors, and measured the current with a meter. Then I could have compared the measured value with the calculated value. Perhaps also, I could have made it so that the students had to take their own measurements, so it might have gone over a little better.

After the lesson, when most of the students realized how easy this really was, one student said to me, "and you really get *paid* to do this?"

Handout for Calculating Electrical Current for a Circuit

Name_____Class_____

Calculate the electrical current for the circuits shown below:

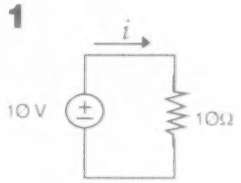
Definitions

Volts: Votage is measures in units called VOLTS.
Ohms: Resistance is measured in units called OHMS.
Amps: Current is measured in units called AMPERES, or AMPS.

Symbols

i	= current	⊕	= battery
Ω	= ohms		
V	= volts		= Resistor
*	= use calculator		

1



Answer:_____

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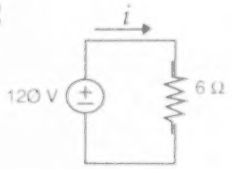

Answer:_____

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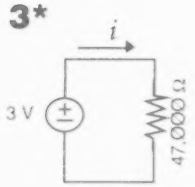

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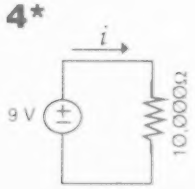

Answer:_____

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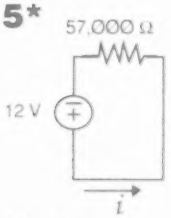

Answer:_____

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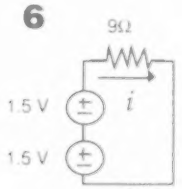

Answer:_____

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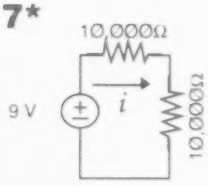

Answer:_____

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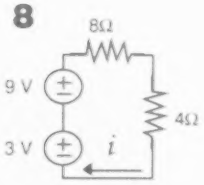

Answer:_____

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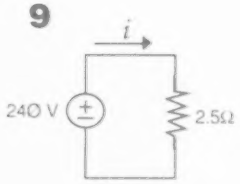

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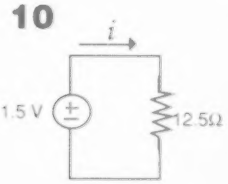

Answer:_____

D-8 The Infamous Peanut Butter and Jelly Experiment (a computer programming problem)

Prepared by Andrew Stewart and Judy Weiss Prescott of Digital Equipment Corporation

While teaching sixth-grade students this year, I wanted to get across to the students the idea of a computer program. I explained that a computer behaves as it does only due to the instructions that a human being puts into the machine. These instructions are in a language that the computer understands, but it is really just a list of things to do, one followed by another.

I then told the students that I was going to pretend to be a computer that understood English. The students were put into groups of three students each. Each group was to write a list of English instructions on how to make a peanut butter and jelly sandwich. After the groups were done, I would ask a group member to read the instructions, which I would then follow. I also told the class that the group whose instructions caused an actual sandwich to be constructed would be allowed to eat the sandwich.

I brought a loaf of bread, a cutting board, peanut butter, jelly, and a knife to class and put them on a desk in front of the class. After about 15 minutes, I asked a group to read to me their instructions. Little did they know, but I was planning to implement their instructions *to the letter*, as a computer would. Remember the familiar phrase, "garbage in, garbage out"?

The students read to me instructions like the following:

- *"Go to the cabinet to get a loaf of bread."*
  I responded by opening the closet door in the classroom, noting that I could not find any bread in the closet. Laughter ensued.
- *"Go to the store to buy some bread, jelly, and peanut butter."*
  I responded by putting on my coat. As I started to walk out of the class, the puzzled students asked what I was doing. I told them that my car was in the parking lot and I planned to leave the class, drive to the store, and buy the items, as they had asked me to do. The class responded almost in unison, "*No*! That's not what we meant." "However," I said, "it is what you just told me to do." On this point, they grudgingly agreed.
- *"Open the loaf of bread."*
  I then tore open the plastic wrapper, allowing the entire loaf to fall onto the table. They laughed hysterically, but I told them that now the bread was open, right? Again, they didn't say "how" to go about opening the bread. "No, you're supposed to untwist the bread tie," said one student. "That's not what you told me to do," I said.
- *"Put the peanut butter on the knife."*
  At this point, I reached my bare hand into the peanut butter jar and covered my fingers with peanut butter, which I then smeared onto the knife. After a round of "Oh, gross!" from the class, I again told them that they never said "how" to get the peanut butter onto the knife.

I think you are probably getting the idea. The instructions to a computer must be extremely detailed and precise, or the computer won't do what you want. My interpretation of their instructions was ridiculous because I was intentionally doing not what they meant, but what they actually said.

Now they were telling me:

- *"Hold the peanut butter jar in your right hand and rotate the lid counter clockwise with your left hand until the lid separates from the jar."*

That's what I wanted from them!

At one point, a student said to me, "You're the dumbest computer I've ever seen." I replied, "You've just gotten the whole point of this assignment! Computers are really the dumbest machines around. They do only what humans tell them to do via the instructions contained in computer programs. Without programs, computers would be useless, expensive paperweights."

A coherent sandwich was never actually constructed, but the classroom did smell of peanut butter for the rest of the day. I don't think that this class will ever forget just how fussy computers can be.

E

Sample Evaluation Forms

E-1 Industry Volunteer Questionnaire 91
(EDC Middle School Math Project)

E-2 Industry Volunteer Questionnaire 92
(EDC Teachers, Time, and Transformations Project)

E-3 Student Questionnaire 93
(EDC Middle School Math Project)

The instruments reprinted here were used in the evaluation studies for various EDC projects that used the industry volunteer model.

E-1 Industry Volunteer Questionnaire

(EDC Middle School Math Project)

Name _____

1. Please choose one of the math classes you taught on Thursday mornings and write about your experience teaching that class. Aside from telling us about the experience in general, it would be helpful if you could answer the following questions:

   How did you decide what you were going to teach?

   Did you ever teach any lessons about your work or the use of math in industry? (If so, please describe.)

   What was most difficult for you?

   What was most rewarding or enjoyable?

2. Looking back at the EDC workshops you attended to prepare you for teaching, what was most valuable?

3. Is there anything you wish the workshops had addressed or covered that they didn't?

4. Have your views about teaching changed as a result of your participation in the project? If so, how?

5. What recommendations do you have for improving the experience of next year's industry volunteers?

6. Is there anything else you think we should know about your experience or your ideas about the project?

PLEASE DO NOT FORGET TO MAIL THIS TO US IN THE ATTACHED SELF-ADDRESSED ENVELOPE BY JUNE 12, 1992. THANK YOU VERY MUCH !

(Questionnaires developed for EDC projects by Education Matters, Inc., Cambridge, MA. Funded by The National Science Foundation.)

E-2 | Industry Volunteer Questionnaire

(EDC Teachers, Time, and Transformations)

Name _____

1. If you designed and taught lessons of your own to your students, would you briefly tell us about these lessons and your experiences teaching them?

2. If you had an industry partner in the classroom, would you describe how you worked together and whether you think this was successful?

3. Have you received any recognition, either formal or informal, within your company for your work on this project? If yes, please describe the recognition.

4. How do your colleagues at work view your participation in this project?

5. Do you have any suggestions for improving the industry component of this project?

PLEASE DO NOT FORGET TO MAIL THIS TO US IN THE ATTACHED SELF-ADDRESSED ENVELOPE BY JUNE 12, 1992. THANK YOU!

(Questionnaires developed for EDC projects by Education Matters, Inc., Cambridge, MA. Funded by The National Science Foundation.)

E-3 | Student Questionnaire

(EDC Middle School Math Project)

Dear Student,

As you know, your math teacher took part in a course on Thursday mornings for middle school math teachers. During those times, an industry teacher taught your math class. We are interested in what you think about learning math and what it was like for you to have a teacher from industry. Please answer the questions below, and then put this in the manila envelope on your teachers' desk.

Do not write your name on this. The manila envelope will be sealed when everyone has finished and then mailed directly to us. Your teacher will not see what you have written, and we will not know your name, so feel free to be completely honest in your answers.

Student Questionnaire EDC Middle School Math Project

Your grade in school: Math course:

Teacher's name:

1. What I like best about mathematics is _____

2. What I like least about mathematics is _____

3. I believe that, to do well in math, I should _____

4. What I liked best about math class this year was _____

5. What has helped you learn math this year? _____

6. Did you use materials like rods, chips, algebra tiles, geoboards, dice or blocks in math this year?

_____ Yes _____ No

If yes, circle the ones you used, and then describe what you did with *one* of these materials. If it helped you learn or understand something better in math, tell how. _____

_____

7. What did your teacher tell you about what he or she did and learned at the course on Thursday mornings? _____

_____

8. What stands out for you about your Thursday morning classes with the industry teacher?

_____

9. Did your industry teacher ever tell you about his or her work? _____ If yes, what did you learn?

_____

10. Do you think learning mathematics is useful to you in your life now? Please explain why or why not. _____

_____

11 Do you think learning mathematics will be useful to you in later life? Please explain why or why not. _____

_____

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12. Check *one or two answers*. What helps me understand a math concept best is

_____ being given a formula or method to do it.
_____ having a model or picture of what it means.
_____ being able to apply the concept to a real-life situation.

13. The grade I got in math this year was _____.